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The Radio Amateur's Journal

8240

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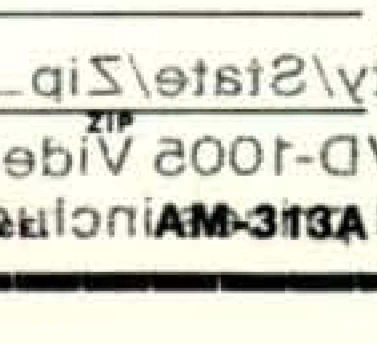

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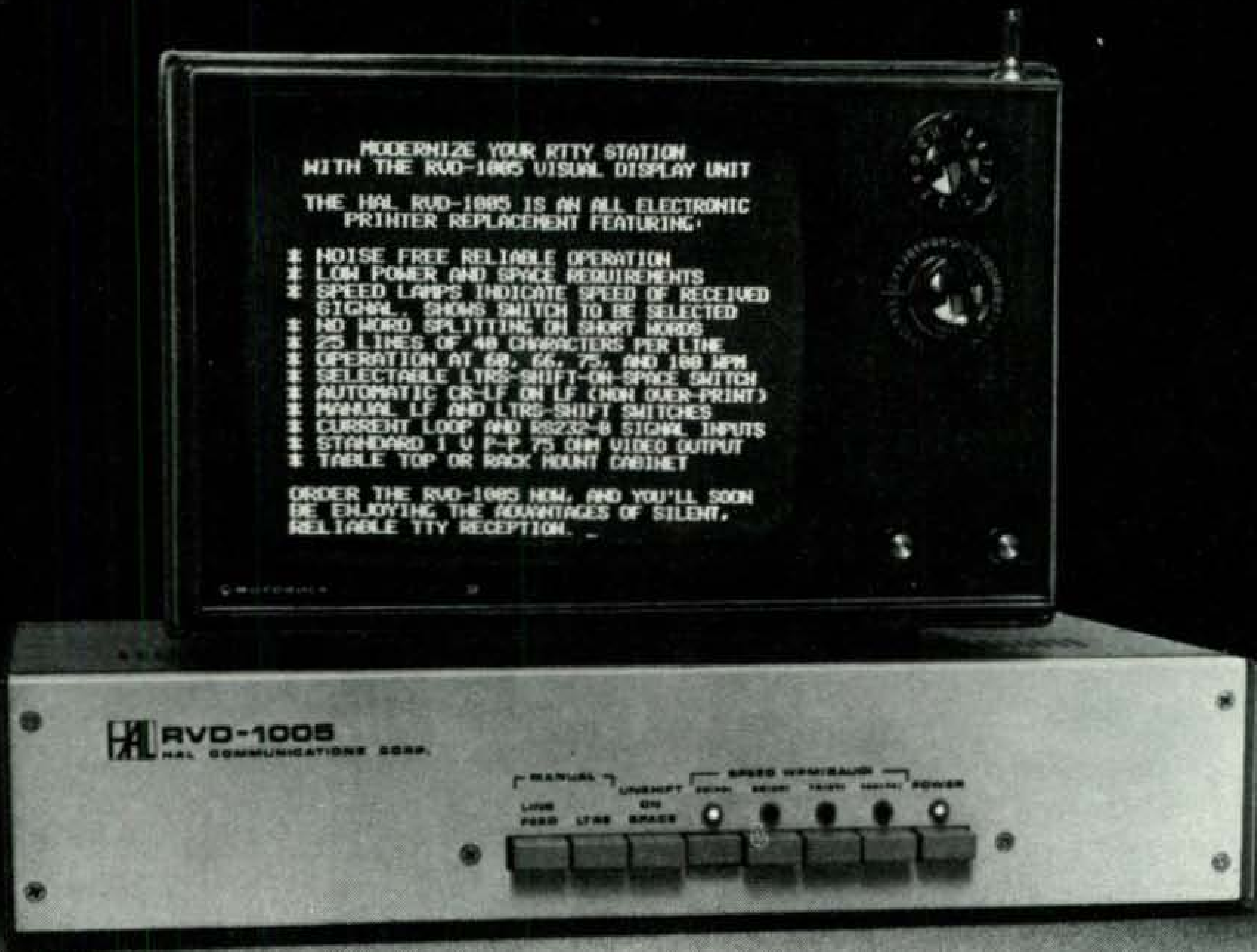

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SEPTEMBER, 1975 **VOL. 31, NO. 9**

The Radio Amateur's Journal

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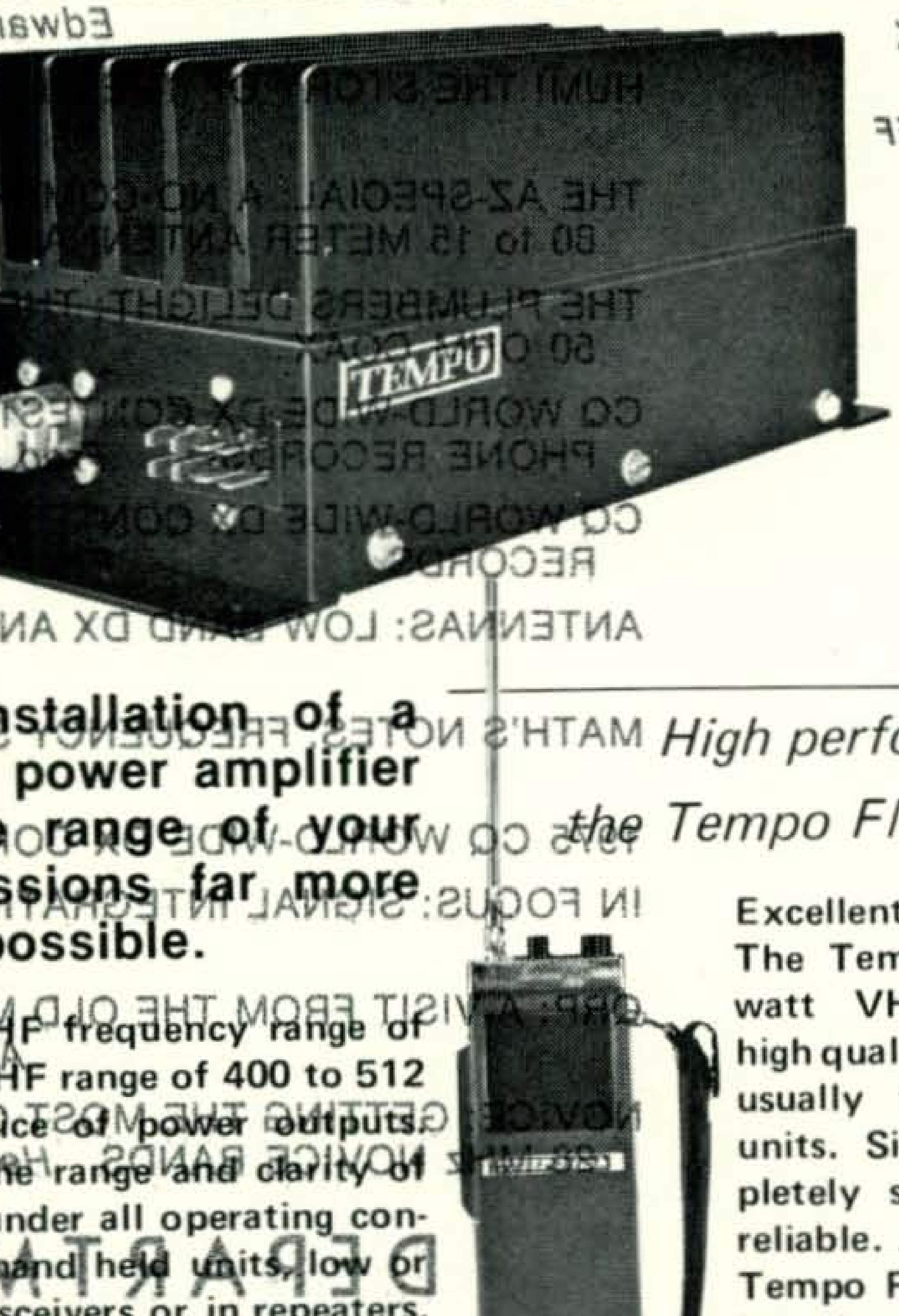

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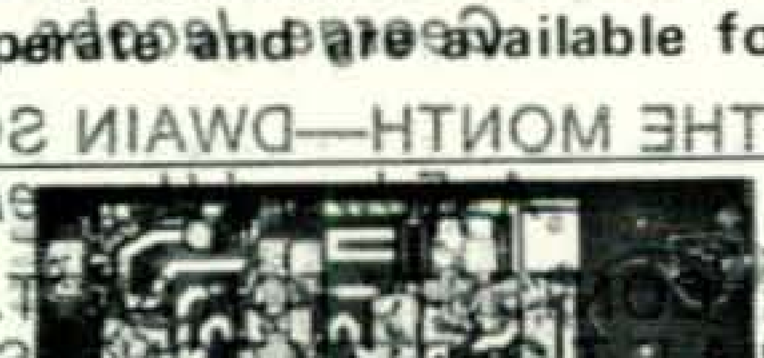

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OUR READERS SAY

Pendergast

Editor, *CQ*:

I enjoy very much reading articles on antennas and Mr. William Orr, W6SAI, certainly has interesting information in his articles in *CQ*. The problem I face in reading these articles is the distraction of the dialogue with Pendergast. He suppresses "yawns" in making comments to Bill he "sniffs" answers, he makes statements "stiffly," he pauses, he exclaims, he looks and in general he's a pain.

I don't know pendergast but I hope he moves away from W6SAI's area. That would permit Bill to write informative articles without the distracting dialogue and allow the two of them to have scheduled QSO's to carry on their conversations as well as make on the air antenna checks. It would certainly facilitate my degesting the meat of the article.

John S. Gustin, K1PZL
Wilton, Conn.

For A Self-Supporting FCC

Editor, *CQ*:

Somewhere it says that "money is the root of all evil," however this statement could also be reversed. Due to the lack of funding, the FCC cannot really do its job of policing the bands and issuing licenses promptly. When a Ham goes down to upgrade his ticket after spending six months studying and sweating his heart out for three hours taking an exam, it's not right that he is expected to wait endless for his new ticket. I took my test April 23, '75 and as of August, I have not received my ticket.

I am a member of the Hall of Science Radio Club and our Net has been QRMd for over two months. The FCC has been unwilling to take action in this case. The ORM consisted of SOS signals, two-tone test signals, poor cw using my call, etc. When this was reported to the FCC, they said that they could not help becuase of "lack of manpower." The same excuse is given for the terrible delays in licensing.

The trouble is this: Our license fees do not go to the FCC, but into the General Fund which means the FCC is not a self supporting agency. They rely upon appropriations for their funds. I want this agency to be self supporting and also be able to validate a license on the spot through the use of a computer terminal which should be installed at their offices. This means money, and that is the root of the evil. The ARRL is sitting on its hands and I'd like them to do a little lobbying in Congress, for a change, instead of writing books and magazines. We need an effective FCC! If they are crying lack of manpower, I'm sure there are quite a few retired "Hams" who would offer their services for a buck a a year to bail them out.

Jim Jaffe, WA2VOS
Brooklyb, NY

The Invisible Ham

Editor, *CQ*:

I am probably over-subscribed to magazines, but the article by William Orr, "The Invisible Ham," (April '75) made my day. As a CBer of many years and without the help of friendly Hams, I am going the full distance alone, including the 13 w.p.m. to get my General ticket. I will appreciate the law and order of the Ham bands, and do my best to preserve it and keep it clean. On the other hand, I will not forget that the Hams I talk to are mostly anti-CBer. I believe that the Ham should try to think positively, try to help the serious CBer, and face up to the fact that CB is here to stay.

Dave Perry, WN5KGL
Ridgecrest, CA

Editor, *CQ*:

My suggestions for Hams wanting to preserve their hobby are:

1. Demand action from their local Newspaper to publish worthwhile, timely news stories on amateur events.
2. Organize donation drives to buy introductory Amateur publications for their local library or school library.
3. Organize a local high school ham club.
4. Seek out CBer's and help introduce them to Ham Radio. (Yes some of them can make the grade.)
5. Buy or beg booth space at the county fair and work a portalbe station and pass out literature.
6. Rejoin the local ham club or start a "perimeter" club in outlying areas.
7. Get out of the shack once in a while and actively recruit friends and neighbors.

The above suggestions may or may not work in every section of the country or may now be in action. The point is that if Hams don't become involved in the preservation and growth of their hobby, Their "harmonics" might only remember" 'ole Dad who once was able to operate his own radio station.'

Don D. Peak
Spring, TX
Awaiting WN5*

*And I've waited 8 weeks so far!

Editor, *CQ*:

It was a pleasure to read Mr. Orr's article in the April issue of *CQ* magazine.

As an ex-KN2 back in the 1950's I was unable to conquer the 13 word per minute code in a 12 month period and thus became discouraged.

To have the Novice license renewable I think would encourage many people to join the Amateur ranks. Also, I like Mr. Orr's idea of having the Novice at 5 words per minute and the General at 10 words per minute. Perhaps the Advanced could be increased to 15 words per minute and then the Extra class either be 15 or 20 words per minute.

Thus, hopefully Mr. Orr's article will stimulate some thinking about upgrading not only in theory of amateur radio but also in the code's speeds. Evidently it is a well known fact that 13 words per minute gives a lot of people problems and so re-structuring

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a bit could increase the number of amateur operators.

William Stroh, III
Short Hills, NJ

Power Measurement

Editor, *CQ*:

I have read with displeasure Mr. Quinn's article ("A Proposed Method for the Establishment of New Amateur Radio Power Limits," *CQ*, June, 1975) advocating power increases of several hundred percent for the Amateur Radio Service.

As Mr. Quinn points, out, the current 1 kw limit was established many decades ago when amateur transmitters, receivers and antennas were quite crude, and when the total ham population was a fraction of what it is today. Undoubtably, the greatest hindrance to amateur communication in 1975 is not lack of signal strength, but the severe interference due to overcrowding of our h.f. bands. The ideal solution, of course, would be a large scale expansion of the bands. Since that seems unlikely, other alternatives must be found to prevent a complete breakdown of the more crowded bands.

There appear to be two viable alternatives:

1. Limit access to the more crowded bands only to higher class licensees. The FCC strongly implied that this would happen at some time in the future in its Report and Order on Docket 19162, paragraph 7, in 1972 (see *QST*, Nov. '72. page 80).
2. Limit the maximum permitted power on the more crowded bands.

Clearly, the latter seems more appropriate. In England, amateurs are permitted only 150 watts. d.c. input while in the USSR the maximum permitted power is 200 watts. Amateurs in these and other countries have demonstrated that dependable worldwide communication is possible with moderate transmitter power. A reduction in our maximum permitted power, at least on certain bands, would permit more reliable communication for a greater number of stations by reducing the overall level of interference. Mr. Quinn's proposal would only lead to more chaos on our already congested frequencies.

Art Harris, WA2LLF
Bethpage, NY

Editor, *CQ*:

Congratulations on a fine selection of feature programming. I am referring to your recent series by Bill Orr, and also the latest feature by Jack Quinn. So my thanks to you and Eimac for a fine job. Keep up the good work, and good luck.

Andrew F. Young, K4RA
Coconut,Creek, FL

Never Without A Safety Belt

Editor, *CQ*:

I am writing this letter in the hope that I may be able to save someone else a lot of pain and suffering: I learned my lesson the hard way!

Whenever climbing a tower to do any work, BE SURE TO USE A PROPER SAFETY BELT, or don't go up!

On 7 June 75, I was standing on top of the top section of a 3 section crank-up tower which we thought was completely lowered. Because of some confusion, the safety belt I was planning to use didn't show up that day. I figured I would be able to stand on top and wrap my left arm around the six foot mast extending above the top while with right hand installing a two meter antenna on top of the mast. Just as I was about to install the antenna, the tower section I was standing on dropped two feet suddenly, I lost my grip and fell off, about twenty feet down to the ground. Luckily I landed rather erect with my knees bent slightly which helped to break the fall and I went down hard right on my rear, and rolled back onto my back in excruciating pain. An ambulance was called and arrived about three minutes later although it seemed like an eternity due to the intense pain I was in.

After the ambulance ride to the hospital, which was very painful, because every little bump in the road sent shots of pain through my body. I was treated in Emergency and X-rayed to find out the extent of injury.

I suffered a hairline fracture of the lumbar number one vertebra, or in other words a broken back.

I have now been in bed for 22 days and shortly will be getting a plaster body cast which will run from just below my waist to my armpits, which I will have to wear for 8 to 10 weeks. Not very pleasant during the summer, however as temperatures in Vancouver rarely exceed 80°C, it might not be too bad.

I figure I was quite lucky in that there was no lateral shift in the fracture and no spinal cord damage, so I will suffer no paralysis.

I am still fairly young (29) and was in good physical shape when the accident happened, otherwise I might have been permanently crippled.

I expect to be released from hospital in about a week.

In a few months I will be able to climb towers again, but NEVER WITHOUT A PROPER SAFETY BELT, as anything can happen.

I hope you print this so that others can learn from my error and misfortune, and avoid injury.

Matthew T. Lewis, VE7CHI
Vancouver, B.C., Canada

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Announcements

● **Hanover Park, Illinois** - A SB-144 was stolen from the locked auto of W9HIL on Saturday, June 28, 1975 while parked at the "Tradewinds" Shopping Center at Barrington and Irving Park Road in Hanover Park. The Serial No. is 620952. If any one receives any information regarding this unit, kindly contact D. L. Holdeman, W9HIL, 1501 Birch Ave. Hanover Park, Il 60103.

● **Uniontown, Pennsylvania** - The Annual Gabfest of the Uniontown Amateur Radio Club will be held on the Club Grounds on Old Pittsburgh Road Uniontown PA. September 6th. For further info contac 438 Braddock Ave., Uniontown, PA 15401.

● **Cherry Hill, New Jersey** - On Sunday, Septembe 7 the South Jersey Radio Association will hold its Twenty-seventh Annual Hamfest at Molla Farms, Malaga, New Jersey. Our Hamfest gives you an opportunity to "meet" your customers. There will be door prizes and limited space for display. Contac David S. Newborg, W2ITG, 857 Longwood Drive, Haddonfield, NJ 08033 for more information.

● **Farmville Virgina** - The Southside Virginia Amateur Radio Society will be operating a Specia Event Station during the week of September 10/16 at the Five County Fairgrounds, Farmville, VA. Fo more infor contact Scott M. Harwood, K4VWK P.O. Box 532 Farmville, VA 23901.

● **Guatemala City, Guatemala** - The Radio Amateu Club of Guatemala has decided to celebrate the Independence of Guatemala with a DXpedition which will be held on September 13, 14, & 15 at Tikal. I is located in the heart of the jungle in Peten, about 350 kilometers north of Guatemala City. For more info contact F. Humberto Cordon, P.O. Box 115 Guatemala City, Guatemala.

● **Harrisburg, Pennsylvania** - On Sunday, September 14, the Central Pennsylvania Repeater Association will sponsor a Hamfest. Gates open 9 a.m. at 200 Block Walnut St., Harrisburg, PA. Registration is $3. For more information contact W3ABF or WA3AVX.

● **Itasca, Illinois** - On September 20th the Indianapolis DX Association will host the Twenty-third Annual meeting of the W9 Central Division Century Club. It will be during the afternoon and evening at Holiday Inn in Itasca, Illinois. Dinner will be served. For more infor and reservation contact Leslie Bannon, W9ZTD, 7008 West 71st St., Indianapolis, IN 46278.

● **Mt. Clements, MI** - The *Swap'N Shop* will be held on Sept. 21, 1975 between 9 & 3 at the L'Anse Creuse Central Jr. High School, 3800 Reimold Rd, Mt. Clemens, MI. Advance admission is $1.00, door - $1.50.

● **Malden, Massachusetts** - The 19-79 Repeater Association's second annual Clambake Hamfest is being held Sunday September 21st at the Tewksbury Rod and Gun Club, 14 Chandler St., Tewksbury, MA. Activities begin at 10 a.m. For tickets and program information contact: Repeater Association Box 221, Malden, MA 02148.

● **Louisville, Kentucky** - The fifth Annual Greater Louisville Hamfest will be held on Sunday Sept. 28 the Kentucky National Guard Armory on Critten-

[*Cont. on page 80*]

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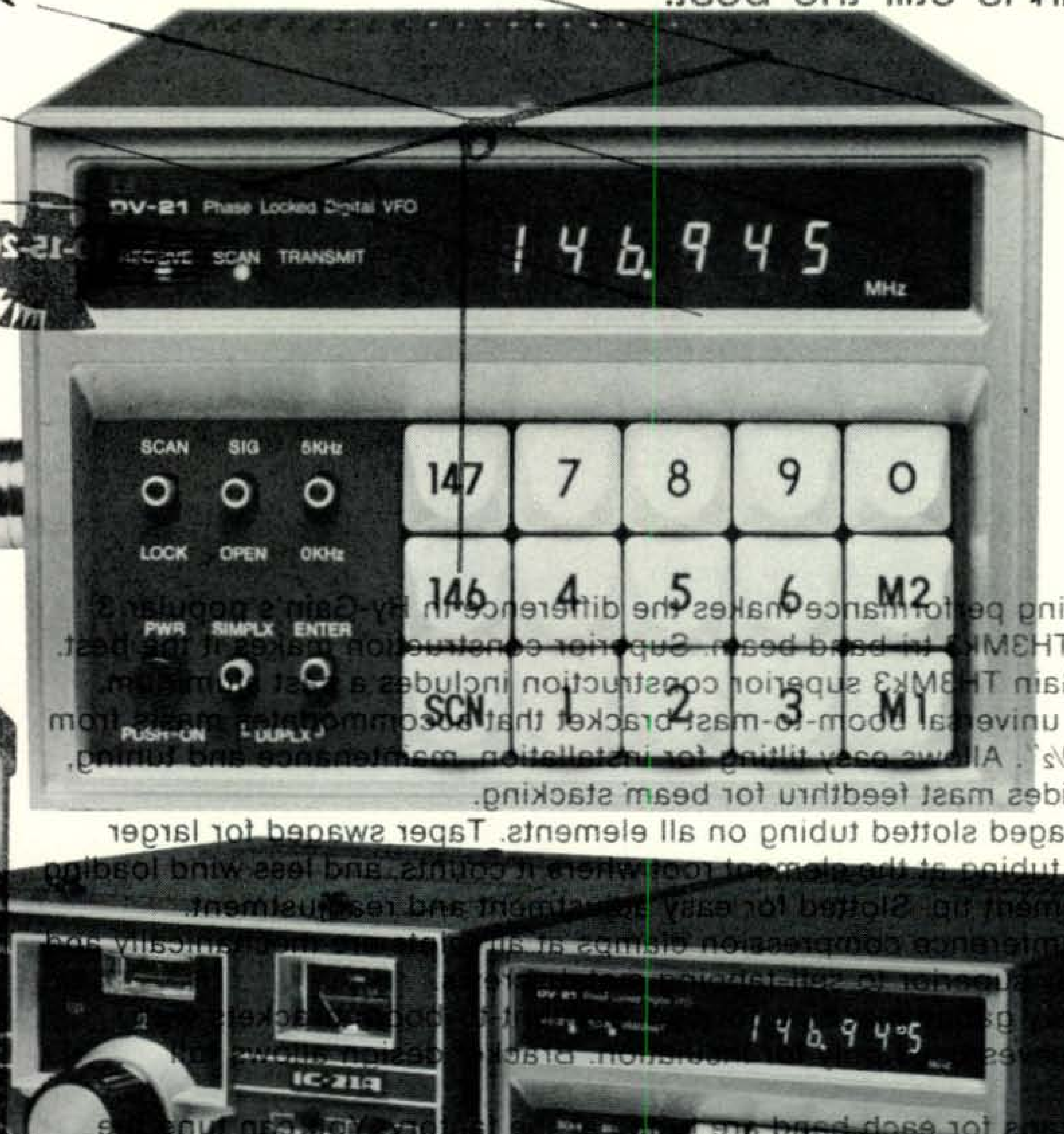
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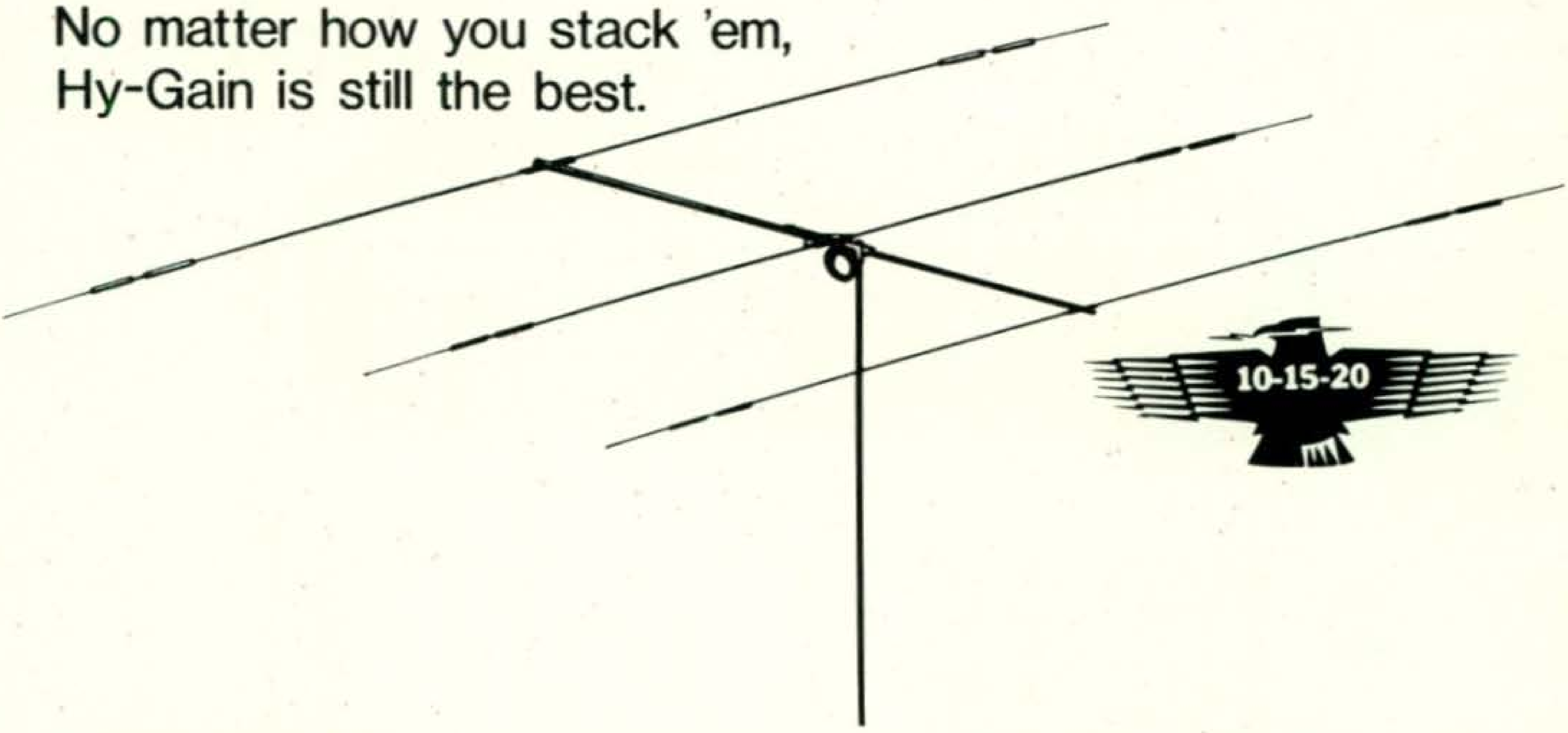

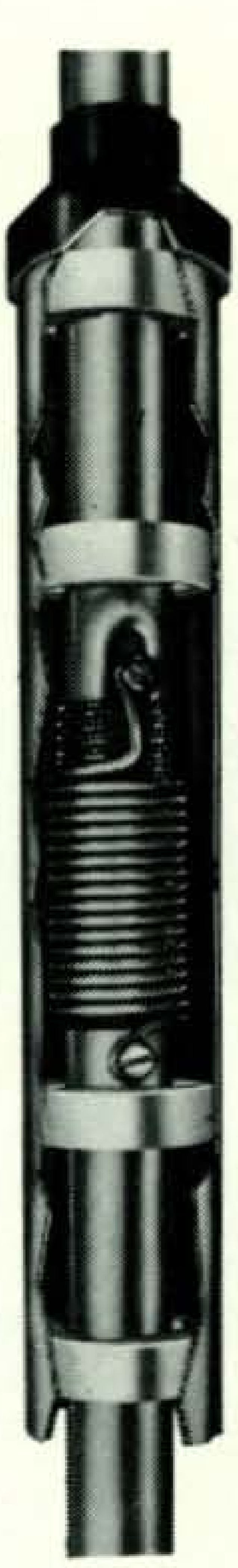

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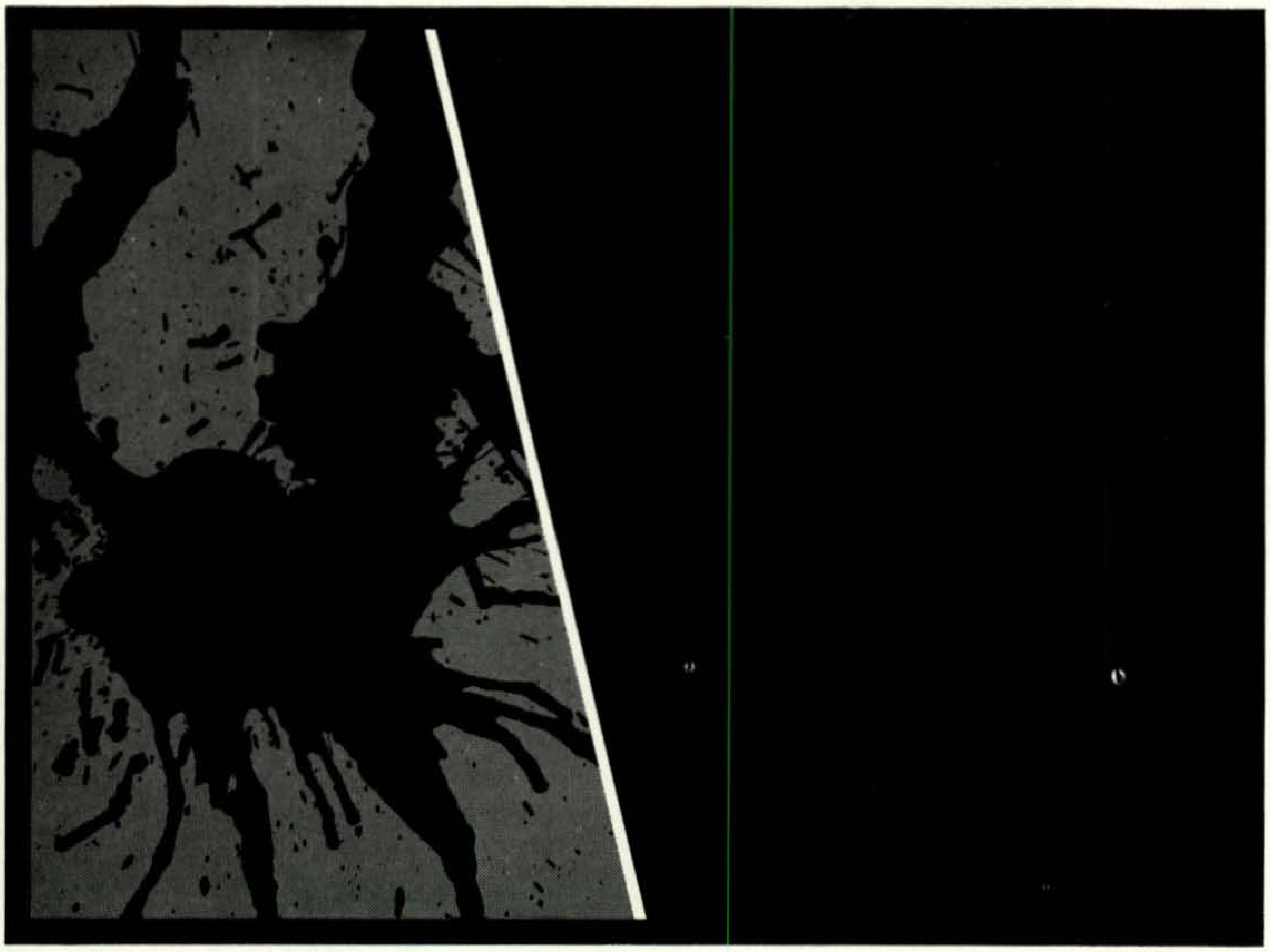

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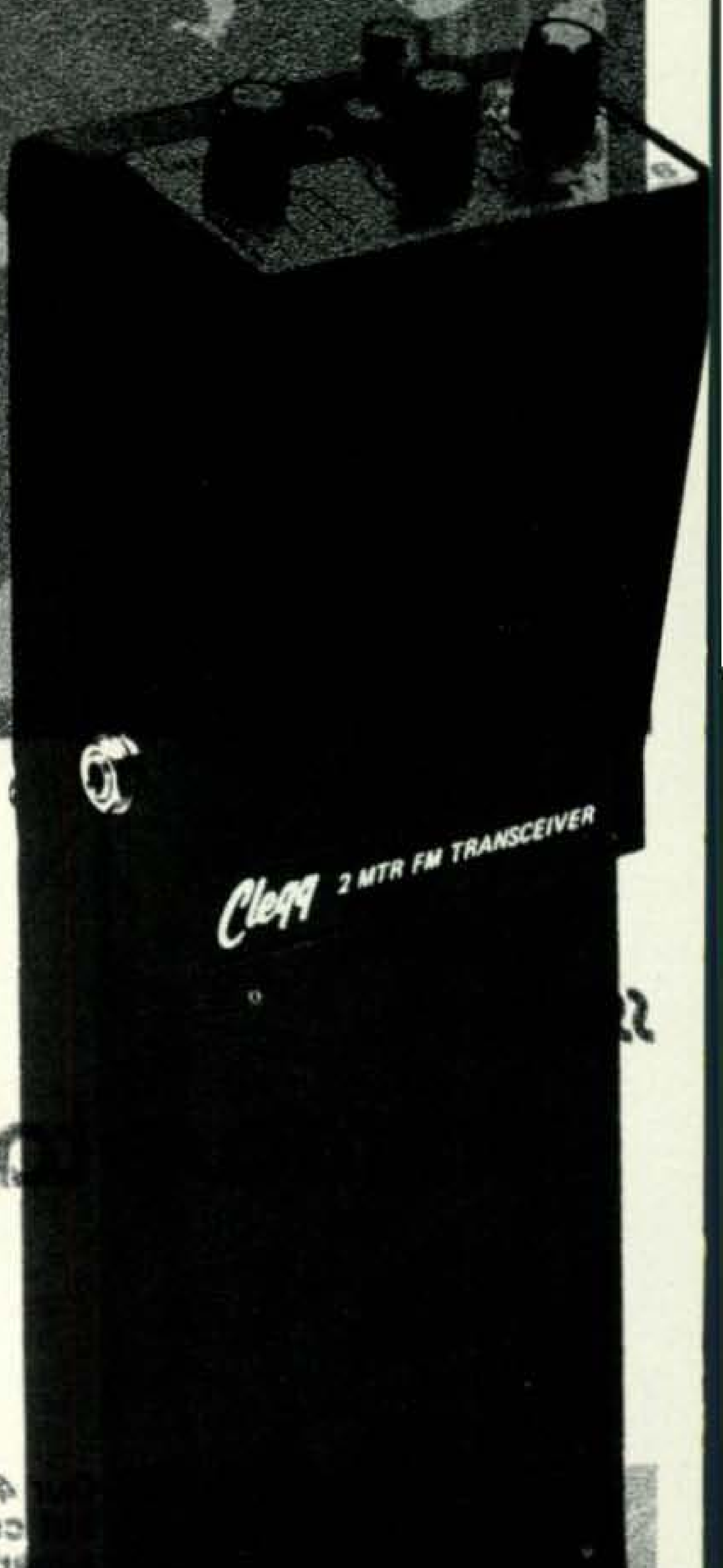

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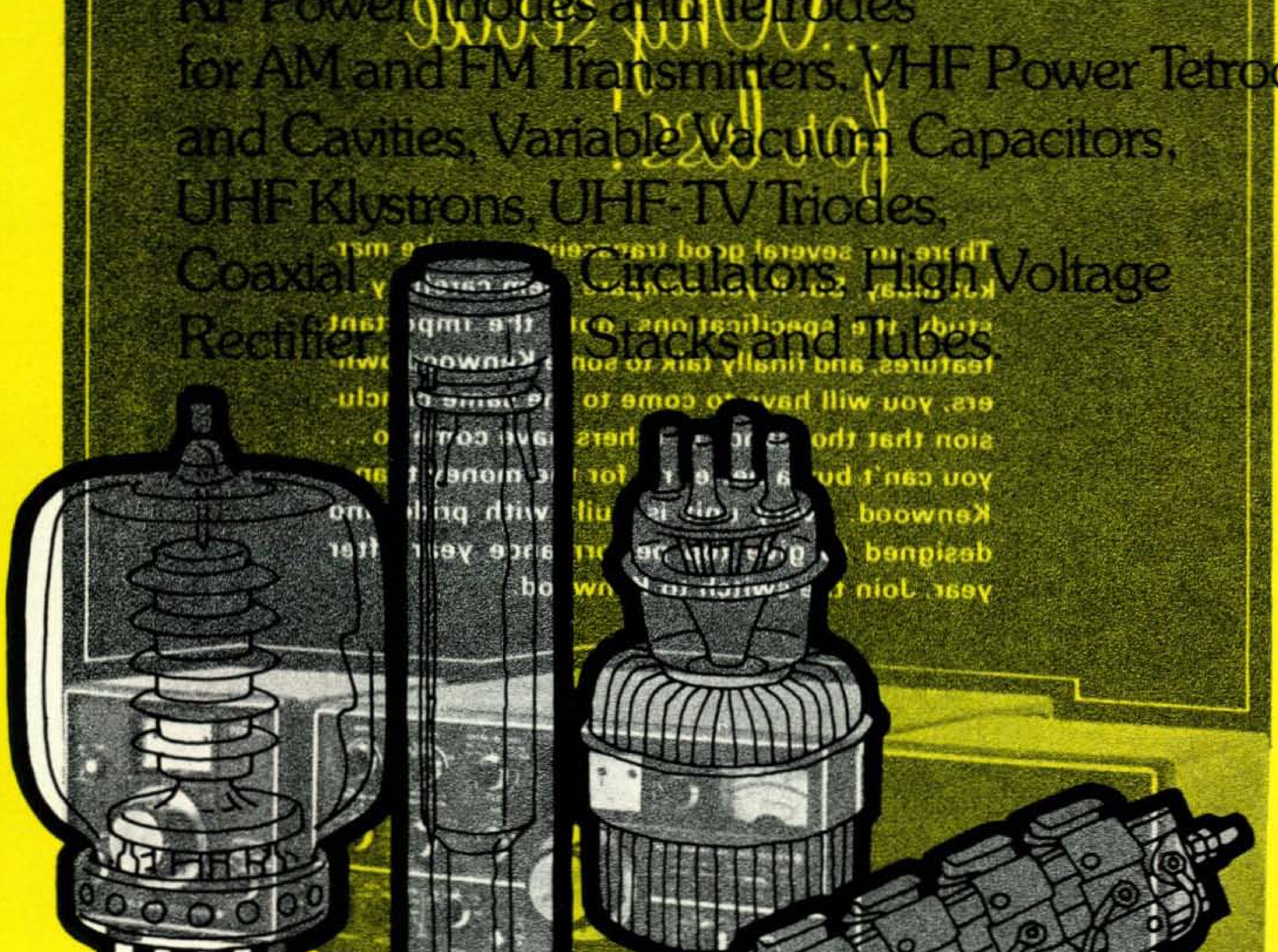

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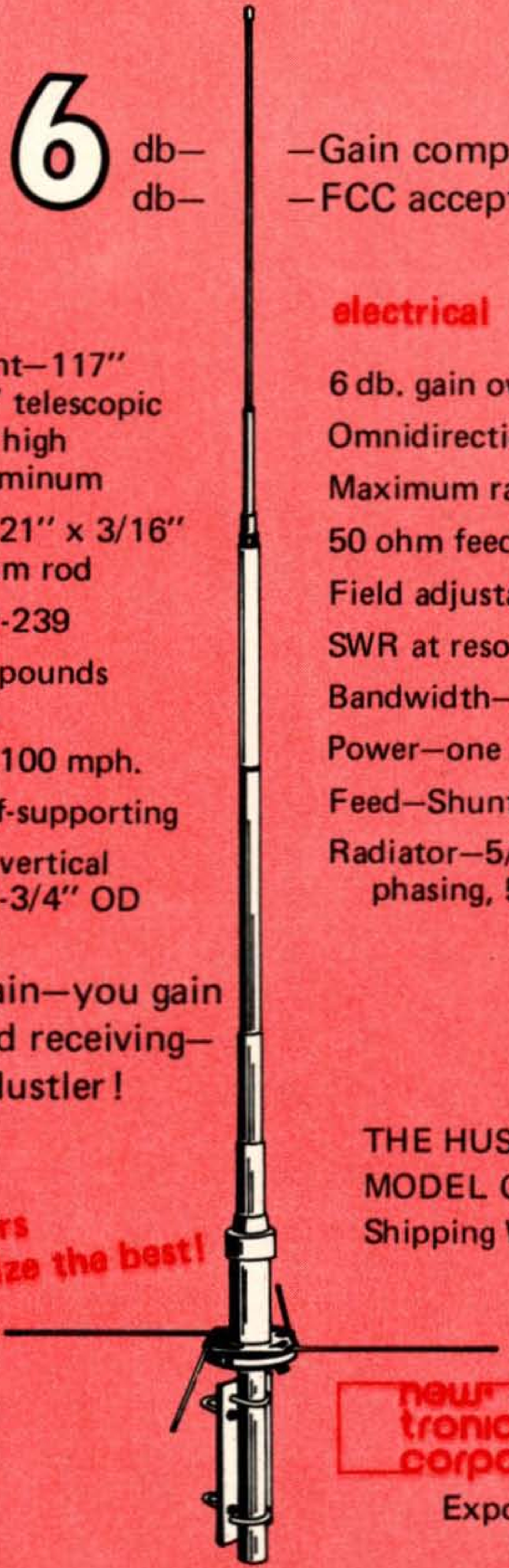

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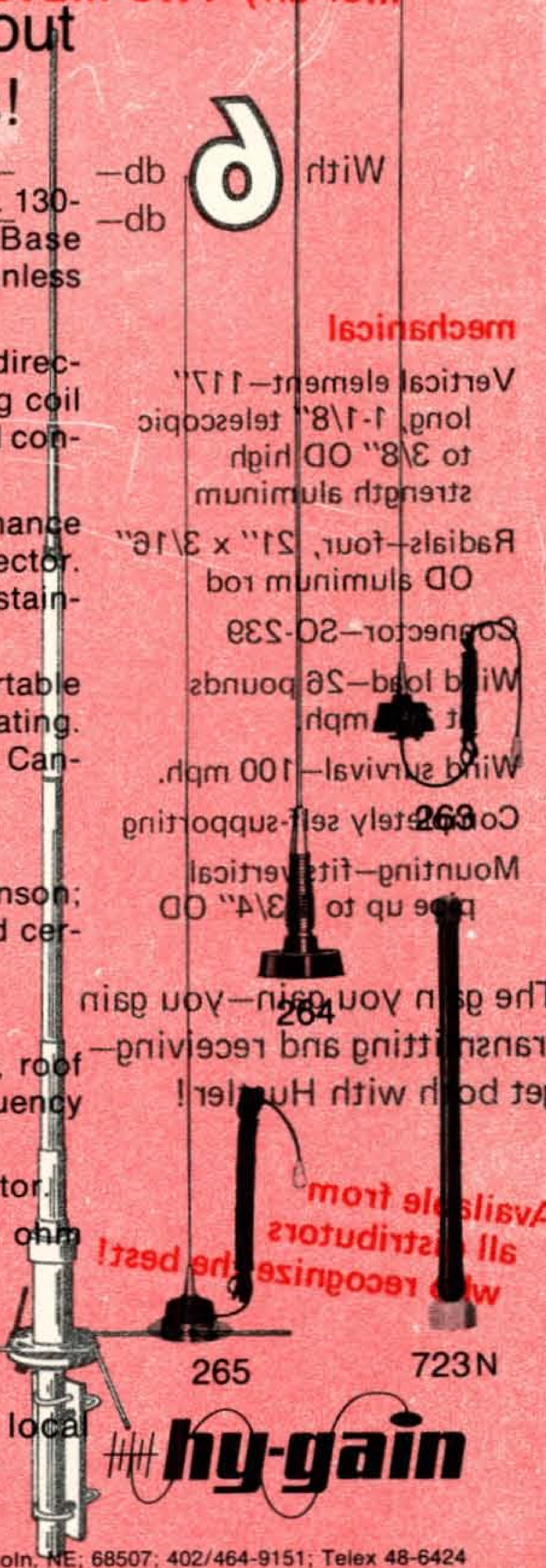

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CW And SSB Break-In With A Vacuum Relay

BY JOE HERTZBERG,* K3JH

Duplex-type operation on s.s.b.? Yes, very nearly so, provided you're using a separate receiver and transmitter.

USE of break-in on c.w. has been fairly common amateur practice over the years. In the early days, a separate receiving antenna was often used for c.w. break-in. With the advent of beam antennas, this method became obsolete. Since then, various improvements such as the use of a high speed vacuum relay for antenna switching, adjustable receiver muting to facilitate monitoring ones own signal, and the like, have resulted in break-in systems for c.w. which are most effective, and a pleasure to use.

On the other hand, little work has been done to improve s.s.b. operation beyond the normal type of Vox. Several years ago, however, Dr. Rom Hildreth, W0IP, devised a system for Instantaneous Voice Interruption (IVI), which permitted break-in on s.s.b. The original unit used batteries, and was difficult to tailor and adjust for good results. In 1973, W6RM, Ray Hitchcock designed an all solid state system for the Drake twins, and W0IP redesigned his unit for the Collins S Line. Both these units use T/R switch devices in the antenna circuits. These units have been described in articles submitted to *QST* for publication.

Before becoming aware of this new work, the the writer late in 1974 designed a system using relays, including the HC-1 Kilovac vacuum relay for antenna switching. This relay has been used for several years at K3JH in the VE3AU c.w. break-in system, with excellent results. Our experience with T/R type antenna switching in the past had been very unfavorable including such problems as suck-out, TVI, and burn out on 28 MHz. On the other hand, vacuum relay antenna switching had been completely successful on c.w. so we were very desirous to extend it to s.s.b. Results on the first all-mechanical model were only fair, but good enough to demonstrate the feasibility of building an s.s.b. QSK system using an antenna relay rather than a T/R switch. Also the test relay system, despite its relatively poor performance, still demonstrated the impressive gain in operating efficiency and pleasure that could be obtained with a properly operating QSK for s.s.b.

At about this time we exhanged correspondence with W0IP and W6RM, and became aware of their new work. Also we discussed the use of antenna relays with Ken MacLeish, W7TX, who was designing a system for s.s.b. with a relay instead of a T/R switch. In addition, we explored a c.w. break-in system, which was being used by a number of local amateurs, and which was partly electronic and partly mechanical. With the experience gained on the first test system, plus the new information gained in these discussions, we concluded that a c.w. and s.s.b. break-in system using an antenna relay was feasible. We concluded performance would be comparable to an all solid state device, but would avoid some of the inherent problems with T/R switches. The result is the c.w. and s.s.b. break-in system using a vacuum antenna relay described in this article.

QSK for the Collins S-Line

The first requirement for break-in operation, either c.w. or s.s.b., is the elimination of backwave in the transmitter. Although details may vary with different makes of transmitters, the basic principles are the same in all units. In the Collins 32S-3, for example, the backwave is eliminated quite easily, as follows. The first mixer grids return to ground via 100 K resistors. Lift these two resistors off ground, and connect them together and to the key line. The mixers then are cut off until the key is closed, and this prevents the backwave signal from getting into the receiver. If a T/R switch is used in the antenna circuit, bad hash from the screens of the power amplifier tubes will be fed into the receiver. When break-in with a T/R switch was first installed at K3JH, it was found necessary to key the screens to eliminate this noise source in the receive mode. With an antenna relay, particularly the small vacuum type, the capacitance between the transmitter terminal of the relay and the other terminals is very low. Hence there is negligible feed-through of screen hash to the receiver in the receive mode. Referring to the K3JH linear relay keying circuit, the relay now keying the antenna relay to provide normal vox operation originally was used to key

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*13 Landover Rd., Bryn Mawr, PA. 19010.

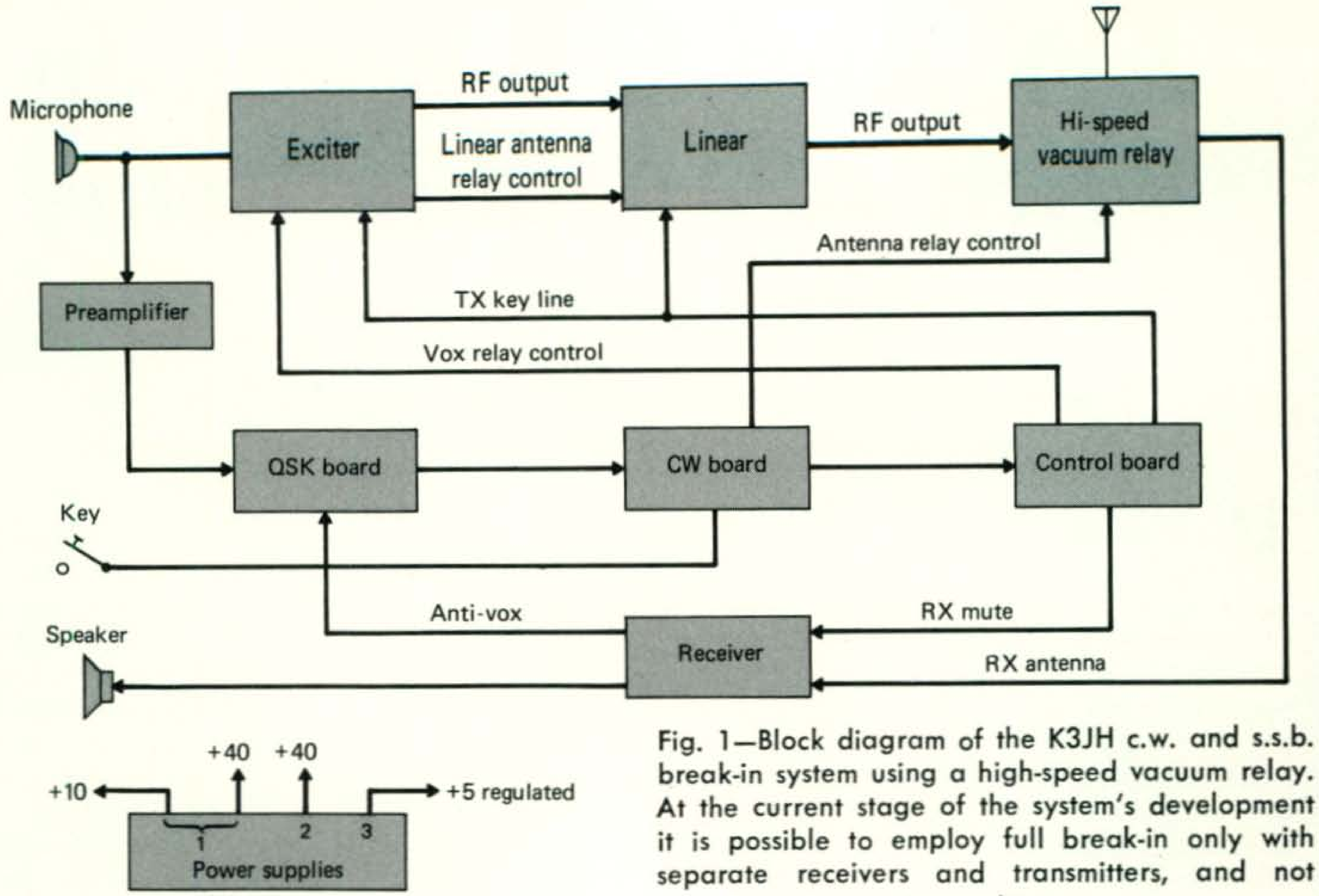

Fig. 1—Block diagram of the K3JH c.w. and s.s.b. break-in system using a high-speed vacuum relay. At the current stage of the system's development it is possible to employ full break-in only with separate receivers and transmitters, and not transceivers.

the screen voltage on and off to eliminate hash. If screen hash is experienced, this is an easy way to correct the problem, or a solid state circuit could be used.

One other minor mod is needed in the Collins 32S-3 for s.s.b. break-in. When the emission switch in the 32S-3 is turned to either USB or LSB, there is a circuit through this switch and the vox relay which closes the key line to ground. In the new s.s.b. QSK system, the key is closed automatically each time the mike circuit is activated with a voice signal. Since the mute circuit in the receiver is activated simultaneously with the voice signal, there is no audible signal in the speaker. Therefore, to make the new QSK system operable, the circuit mentioned above must be de-activated. This is easily done as follows. Find the white with blue tracer wire going into the vox relay terminals. Clip this wire leaving an inch or two of lead from the vox relay terminal. Then splice two wires to the two open ends, and carry these to a miniature toggle switch mounted at any convenient point on the 32S-3. On s.s.b. QSK, throw the switch to the open position. For normal s.s.b. operation, close the switch. No other mods than those described above are needed on the 32S-3. On the 75S-3B, it is desirable to speed up the a.g.c. in the fast position by shunting a 58K resistor across R_{24}, which can be done without removing the receiver from the cabinet. With these changes, both units are ready for c.w. or s.s.b. QSK. Essentially the same mods can be made to any make transmitter or receiver to fit them for QSK. The specific mods required should be readily determinable from an examination of the transmitter and receiver circuits.

Performance

The performance of the break-in system itself is really excellent. First, there is no relay clatter as experienced with many vox systems. All one hears is his own voice as he talks into the mike, and in between words and syllables the faint hiss of the receiver if the gain is high enough. Almost any signal which comes up on the frequency is heard immediately. I say "almost any signal" for this reason. If a station desiring to break-in says just the word "break" it could be missed, because you could be saying a word into the mike at precisely the same time, which would cover it up. If several words are spoken, or if a single word is properly timed, you will hear the breaker with no trouble at all, since there is almost continuous switching of the antenna between the transmitter and the receiver while you talk. If the breaker just starts to talk on a break, you hear him almost immediately, and you stop talking, so very little is missed. It is almost the same as an interruption on a duplex telephone line. To continue on performance, the system works beautifully on phone patches. The person on the patch does his own switching of the transmitter with his voice. With this type of QSK operating at both ends of a patch, one can visualize a patch operating just like a duplex phone circuit. It is virtually impossible to "double" with this system, beyond a word or two. So the system could be most helpful for net operations and group ragchews. The system is relatively insensitive to tripping

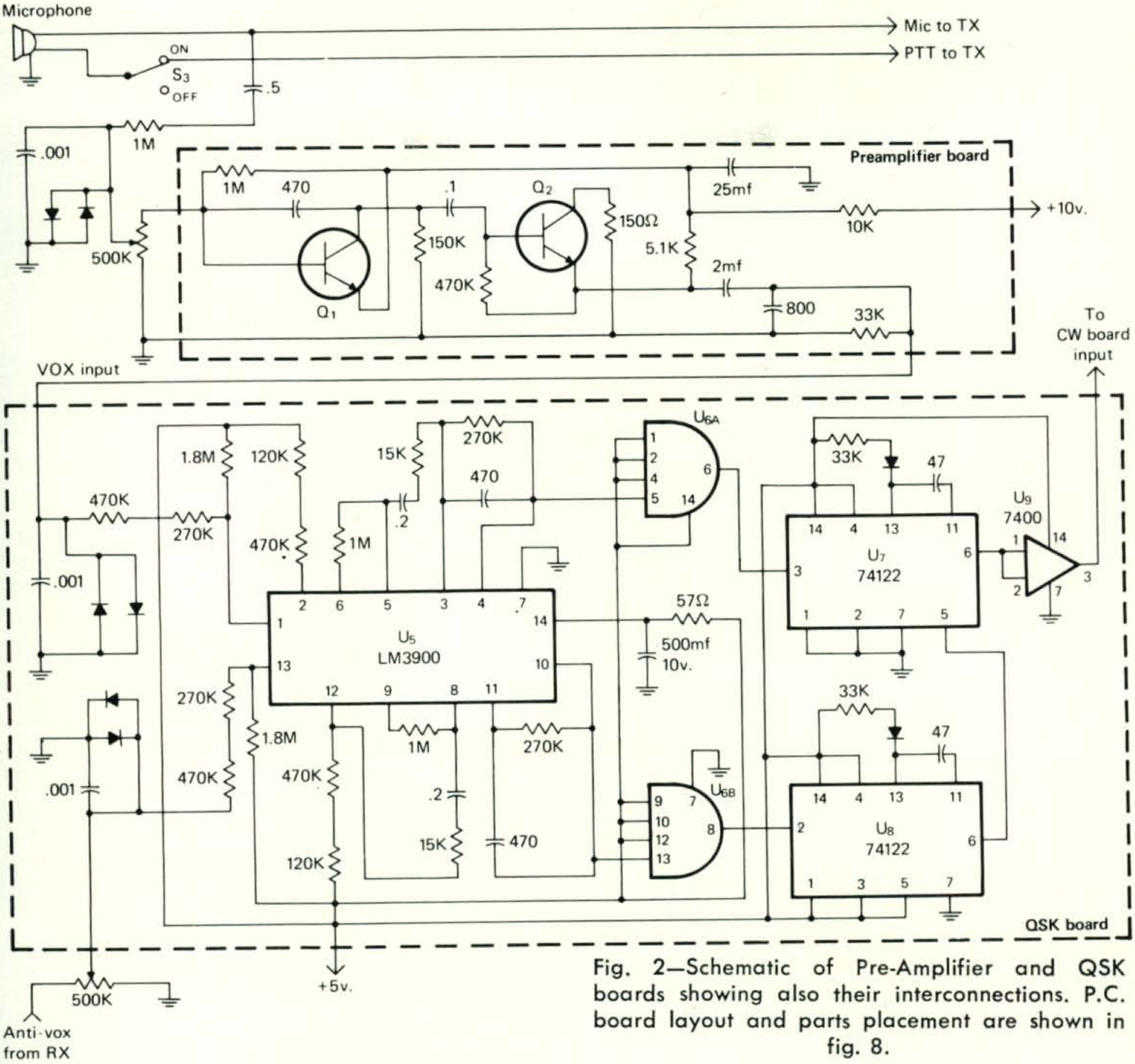
Microphone
Mic to TX
PTT to TX
ON
S3
OFF
.5
1M
.001
500K
Preamplifier board
1M
470
.1
Q2
25mf
150Ω
+10v.
10K
150K
5.1K
2mf
470K
Q1
800
33K
To CW board input
VOX input
U6A
270K
1.8M
120K
15K
470
33K
47
470K
U9 7400
270K
.2
470K
1M
U7 74122
.001
U5 LM3900
57Ω
500mf 10v.
270K
1.8M
1M
270K
470K
470K
.2
U6B
U8 74122
15K
470
120K
QSK board
500K
Anti-vox from RX
+5v.

Fig. 2—Schematic of Pre-Amplifier and QSK boards showing also their interconnections. P.C. board layout and parts placement are shown in fig. 8.

from sudden loud signals on the speaker, and a slight audio readjustment usually clears any problem. The Vox and anti-Vox have always been difficult to adjust at K3JH, so push-to-talk has usually been used. The system is such a pleasure to use, and adds so much to operation, that PTT now seems archaic after only a few weeks with s.s.b. QSK. Note that if one wishes only c.w. QSK, the QSK and Pre-amp board can be omitted. For s.s.b., however, all boards are required. Finally, this system should be usable with any make of equipment, excluding of the moment transceivers, with the proviso that the transmitter can be modified to eliminate backwave as previously described.

The only disadvantages we have found are relatively minor. If the receiver at the far end has too slow an a.g.c., then some break-up or flutter will be noted on your signal. Since your signal is turning on and off very rapidly many, many times as you talk, the slow a.g.c. is unable to follow these changes, which in turn causes apparent flutter, break-up, or clipping. In many cases, transceivers have no external a.g.c. adjustments. The condition previously described can often be corrected in such units by turning down the r.f. gain control. Contacts during several weeks were tabulated, and it was found that reports of this sort amounted to less than 10% of the total. With very few exceptions, those experiencing the a.g.c., or overload problem, had no trouble with intelligibility. In addition to the a.g.c. problem, some observers reported a difference in the sound of the QSK signal versus the normal push-to-talk signal. We have decided that a keen ear can tell some difference because the audio is being cut off sharply between words and syllables. Apparently to some, the signal does not sound as fully rounded out, or as resonant, due to the sharp cut off. To use an old term, the audio has zero or very low decrement. Most of those who observed this effect did not

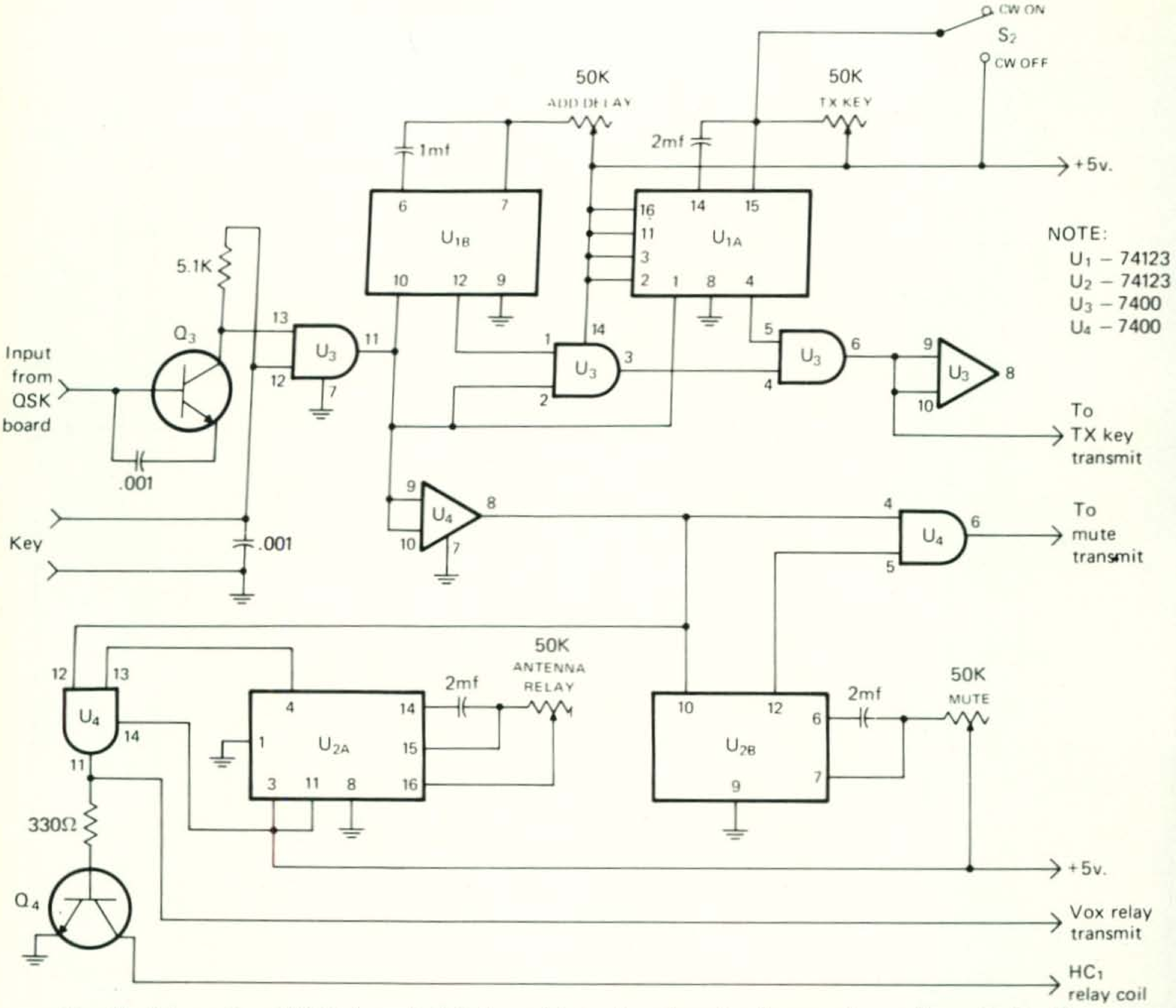
CW ON
S2
CW OFF
50K
ADD DELAY
50K
TX KEY
1mf
2mf
+5v.
NOTE:
U1 – 74123
U2 – 74123
U3 – 7400
U4 – 7400
U1B
U1A
5.1K
Q3
Input from QSK board
.001
Key
.001
U3
U3
U3
U3
To TX key transmit
U4
To mute transmit
U4
50K
ANTENNA RELAY
2mf
U2A
50K
MUTE
2mf
U2B
U4
330Ω
Q4
+5v.
Vox relay transmit
HC1 relay coil

Fig. 3—Schematic of C.W. board. P.C. board layout and parts placement are shown in fig. 9.

find it annoying, and in fact observed they became accustomed to the sound very quickly. Many did not notice this characteristic at all, even when it was called to their attention. Considering the inherent advantages of s.s.b. QSK, these disadvantages do not appear to be too significant. In a rare instance, if needed, the QSK is readily disabled.

On c.w., the QSK system performs as well or better than the original VE3AU system. One disadvantage is that the antenna relay and the transmitter are triggered on separate channels. Hence, the system is not "fail safe" like the VE3AU. The advantages again seem to outweigh this. As a check, several tests were made running full power into an open antenna relay. Aside from the plate tank arcing over, there was no damage to either transmitter or the relay. If the VE3AU circuit as normally used was converted to a negative grounded power source, it should be usable as the keying device in an s.s.b. QSK. This would restore the "fail safe" feature. This has not yet been checked at K3JH, using the latest c.w. and QSK boards.

Operation

Referring now to the block diagram of the K3JH system, note that the c.w. board is the basic building block for the QSK device. When the key is depressed, the four IC's on the c.w. board perform the following functions:

A—Mute the receiver
B—Close the antenna relay
C—Close the exciter vox relay
D—Key the transmitter, including the linear if used.

These functions are actuated on an adjustable, timed sequence, so that there are no clicks in the speaker, the transmitter does not turn on until the antenna relay is closed, and the vox relay is automatically held down for selectable time periods. When the key goes up, the sequence is reversed with the mute opening last to eliminate clicks. A pot across the mute circuit permits your own signal in the receiver to be adjusted to a comfortable level for monitoring purposes. One pot on the c.w. board permits a wide adjustment of weighting. The control board, actuated from

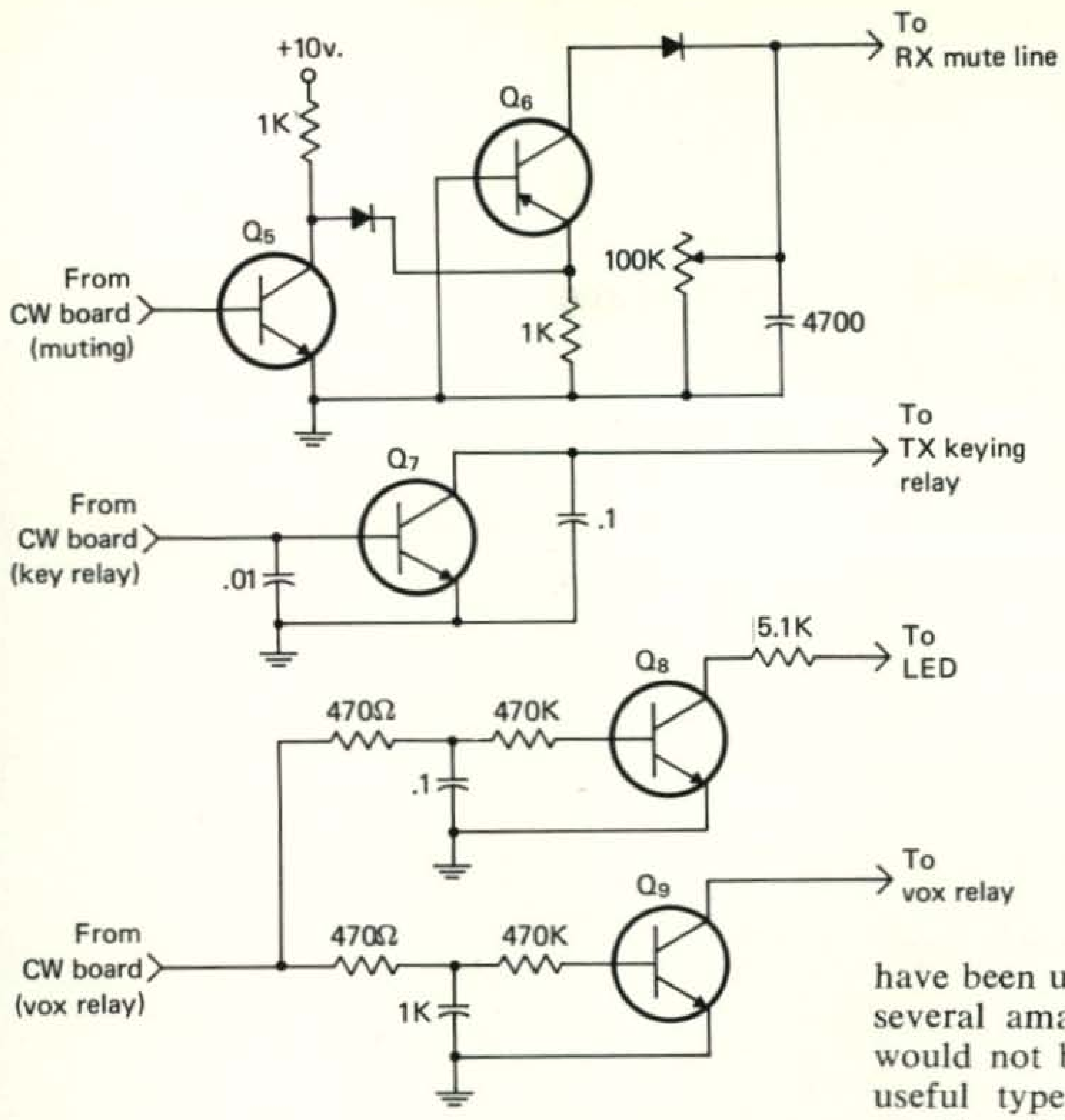

Fig. 4—Schematic of Control Board. P.C. board and parts layout are shown in fig. 11.

the c.w. board, contains the muting circuit transistors, a transistor which actuates the transmitter keying relay, the vox relay transistor, and the transistor to actuate the LED for monitoring the operation of the QSK.

Relays

A relay is used for keying the transmitter, because we found several solid state circuits to be unreliable. This was due to r.f. pickup. This could be corrected, of course, but since this seemed to be the only part of the circuit sensitive to r.f., we decided to go the relay route. The relay used at K3JH is the HG1017. This is a highly reliable mercury wetted relay readily available from many surplus houses, and usually quite inexpensive. It requires an octal socket, and a 40 volt d.c. supply. There are many reed relays available, which are quite reliable, and which operate on 5 volts d.c., which would be quite adequate. We prefer the one specified. There are no timing problems using one of these relays in this circuit. Th HC-1 Kilovac relay closes in about 1.8 milliseconds including bounce, and the mercury wetted or reed relays are as fast, but must be delayed anyway to permit the antenna relay to close first, so that r.f. switching of the antenna is done in a "cold" circuit. The whole system operates in less than 5 milliseconds. Since a single dot at 60 w.p.m. takes 20 milliseconds, this delay time is negligible on s.s.b. Although the mercury wetted and reed relays operate at these high speeds, neither are suitable for antenna switching because they will blow up if used with a linear amplifier. The HC-1 on the other hand is rated at 5 kw, which is amply safe for amateur operation. The coil of the HC-1 is 335 ohms. The best results are obtained using a supply voltage of about 40 volts d.c. and a 170 ohm dropping resistor, which will provide 26.5 volts across the relay coil with the key down. This gives a "hot shot" effect, which gives closure times under 2 milliseconds. Independent measurements by **W7TX** have confirmed these figures. It should be noted that one of the small, fast, open frame relays have been used successfully for c.w. break-in by several amateurs, and there is no reason they would not be suitable for s.s.b. QSK also. The useful types have very light armatures, and usually coil resistances of several thousand ohms. The disadvantage of these relays is that the contacts go bad over a period of time, since they operate in open air. Most of the larger vacuum relays are unsuitable because the closure time is too great. Unless the relay will operate in the order of 2 milliseconds or so, the inherent delay in the relay will cause short dots on c.w., and clipped syllables on s.s.b.

From time to time, sources become available for unused, surplus HC-1 relays, or the equivalent from other manufacturers. Prices have ranged from $25 to $38. The relays can be obtained new from Kilovac for $54. Mercury wetted relays are available from most surplus dealers. Herback & Rademan in Philadelphia, for example, sell used HG1017 relays at a price of $9 for six pieces, or $1.50 each. Miniature 50K pots are available from H & R at a price of $4 for ten pieces. Otherwise, practically all the QSK parts can be purchased at Radio Shack, or your favorite electronic parts or surplus dealer.

Continuing the circuit description, the vox circuit in the QSK unit contain two mercury wetted relays. The first of these utilizes the two normally open contacts to close the vox relay in the exciter via the push-to-talk switch, and also to close the second vox relay, which is operated from a separate power supply. The second relay has two large capacitors arranged so that the exciter vox relay is held closed either for ten or twenty seconds after you stop talking into the mike, dependant on the setting of the "add vox delay" switch. This circuit, and these two relays are a pure nicety, which adds a great deal of

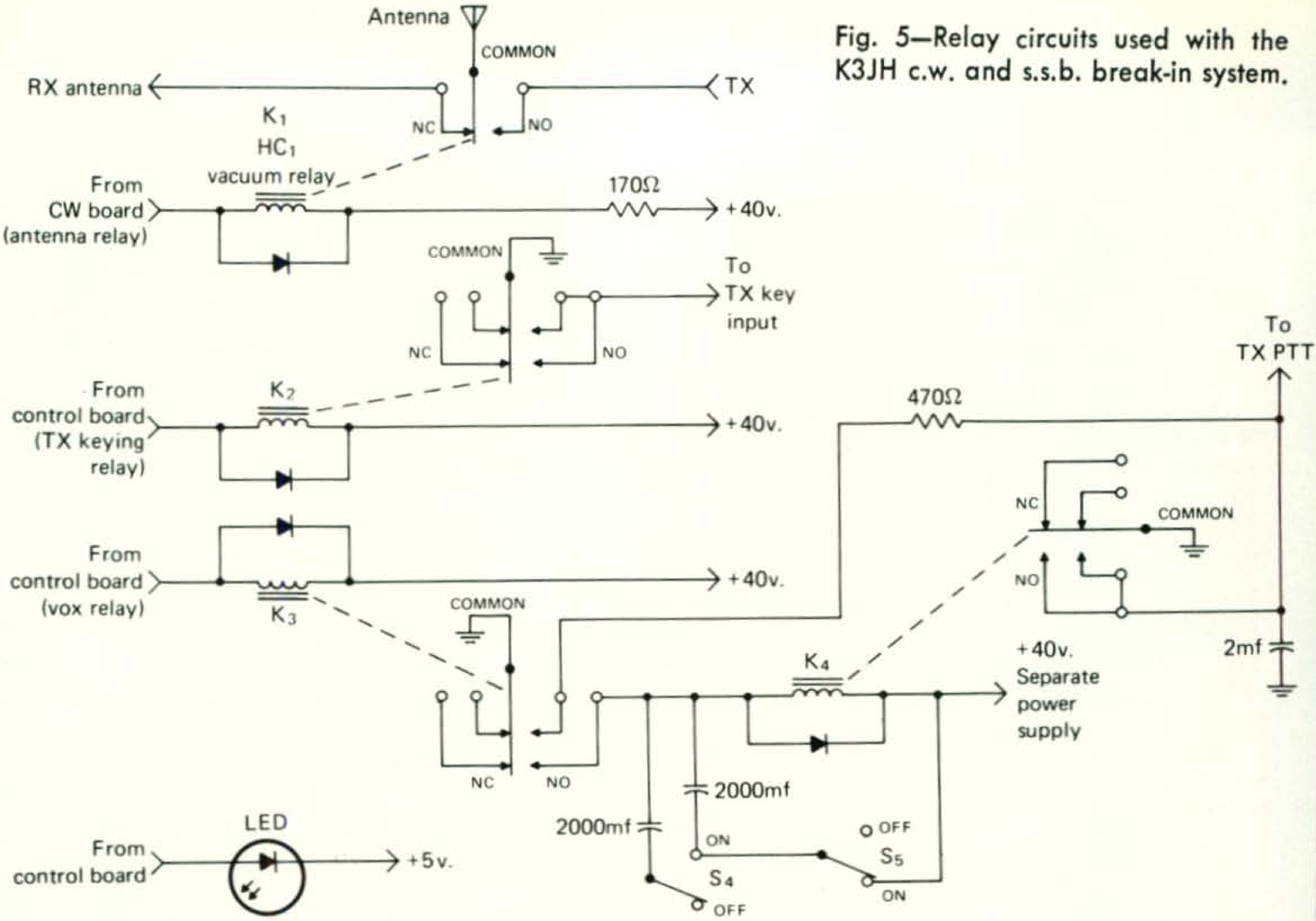

Fig. 5—Relay circuits used with the K3JH c.w. and s.s.b. break-in system.

pleasure to operation of the QSK unit. If omitted from the unit, the PTT switch can be closed continuously during s.s.b. operation, or the exciter vox circuits can be used for more limited automatic operation. Remember that the exciter vox relay in the new mode of operation serves only to activate the exciter circuits, and the linear antenna relay, etc., but is not used in the break-in function.

The c.w. circuits at K3JH include the linear keying arrangements shown separately. The three relays shown in series in the plate circuit of the triode key the two linears specified by closing the filament return path to ground, and the antenna relay for normal s.s.b. operation. For break-in s.s.b., the antenna relay is disconnected from this circuit, since it is then controlled from the c.w. board. The advantage of the linear keying as shown is that no plate current is drawn by the linear until the key is closed, either on c.w. or s.s.b. Remember that the linear antenna relay is closed automatically by the exciter vox relay whenever power is applied to the linear. The keying circuit saves power, and extends tube life, with no degradation in signal.

On c.w., performance is excellent. The IC board performs slightly better than the VE3AU circuit in that one can hear a break signal on a string of dots at over 40 w.p.m., or about 5 w.p.m. faster. The fail safe feature of the VE3AU circuit has been sacrificed as mentioned previously. Adjustment of the pots on the c.w. board is quite simple. The mute pot is adjusted so as to eliminate clicks in the receiver, usually near the maximum resistance. The antenna relay pot is adjusted so the tail off of each dot is smooth on the scope. If incorrectly adjusted, the dot will tail off in a square wave drop off to the base line on the scope, which causes clicks. The transmitter relay pot is shorted out on c.w., and the adjustment for s.s.b. will be covered later. The add delay pot permits the weighting to be adjusted over a fairly wide range. At K3JH, the pot is usually set for a weighting of 55%, which gives the most pleasing c.w. to us. The weighting adjustment can be done on the scope, or with a meter across the key line to the transmitter.

For s.s.b. QSK, the mike line is tapped for audio, which is fed into a two stage transistor amplifier with a gain in the order of 30 db. With an Electro-voice 676 mike, one must really close talk to avoid clipping the output signal, so if this type mike is to be used continuously, additional pre-amplification should be provided. With an Astatic 10D, the preamplification shown is adequate. We preferred this input circuit rather than tapping into the Collins vox amplifier because it made the QSK system more easily adaptable to equipment other than Collins, less transmitter modification was required, and it seemed more easy to adjust. The balance of the QSK board contains circuits similar to those first designed by W6RM. Since the timing of the break-in system in the K3JH system is built into the c.w. board, most of the delay in the 74122 chips has been eliminated by using very small 47 pf capacitors. Anyway, the preamp output signal is further built up in one half of the LM3900 quad amplifier, whose output feeds one half of a Schmitt trigger. The output of the Schmitt trigger actuates the 74122 monostable multivibrator during voice syllables. The output of the 74122 is inverted and the positive pulse triggers Q_3, which triggers the transmitter just as though the c.w. key had been depressed. Anti-vox from the receiver feeds through the other half of the quad amp into the other half of the Schmitt trigger, and into the second 74122 designated as U_8. The output of U_8 is fed into U_7 through terminal 5, which inhibits U_7 from triggering on a signal off the speaker. When you speak into the mike, this circuit is overridden, and the transmitter actuated as described previously.

Only one gate is used as an inverter on U_9. An extra inverter is available on U_4, which, if used, would eliminate U_9. This would necessitate running two wires between the c.w. board and the QSK board. If the trouble is worth it, a few cents in construction cost can be saved this way.

Construction

At K3JH, an aluminum chassis 11″ long, 7″ wide and 1 and ¾″ deep provides plenty of room for three power supplies, wiring, and board mounting. The boards are mounted vertically on top of the chassis using light aluminum angle bolted to the ground planes on each boards. The front panel is 8″ by 8″ on which are mounted: On/off power switch, Pilot light, LED indicator, Vox delay on/off switch, Switch to add Vox delay, Mike PTT on/off switch, SSB/CW switch, Mike input jack, Pot for Mute adjustment, Vox gain pot, Anti-vox gain pot.

The mike output jack is on the back of the chassis. Also on the back of the chassis are 7 phono jacks for the following interconnecting shielded phono cables: Anti-vox from the receiver, PTT to the transmitter, Key input, Key output to the transmitter, Mute line from the receiver, Two power leads to the HC-1 relay.

The HC-1 relay is mounted in a small separate box with coax fittings for the transmitter and antenna leads, and a phono jack for the receiver antenna lead. This permits the relay to be placed in a convenient position with minimum disturbance to the existing coax wiring in the station. Obviously the QSK unit could be made much smaller. The power, except for the vox relay circuit, could be obtained from the transmitter by use of suitable dropping resistors, one regulator, etc. All this is a matter of individual preference, and would have no effect on the performance of the QSK system if properly done.

The circuit boards are also relatively large, which makes them easy to produce in the basement. The drawings can be traced, and transferred to the raw copper-clad board using carbon paper, or photographed and used directly since they are actual size. The only difficult part is the IC socket drawing. Sockets were used for the chips, but all transistors were soldered in, since they are so easy to remove if a replacement is needed. The usual care must be excercised to avoid solder bridges, especially on the IC sockets, and of course parts must be mounted correctly. Otherwise the circuits are not sensitive in the least to wire dress, r.f., or otherwise. Be sure,

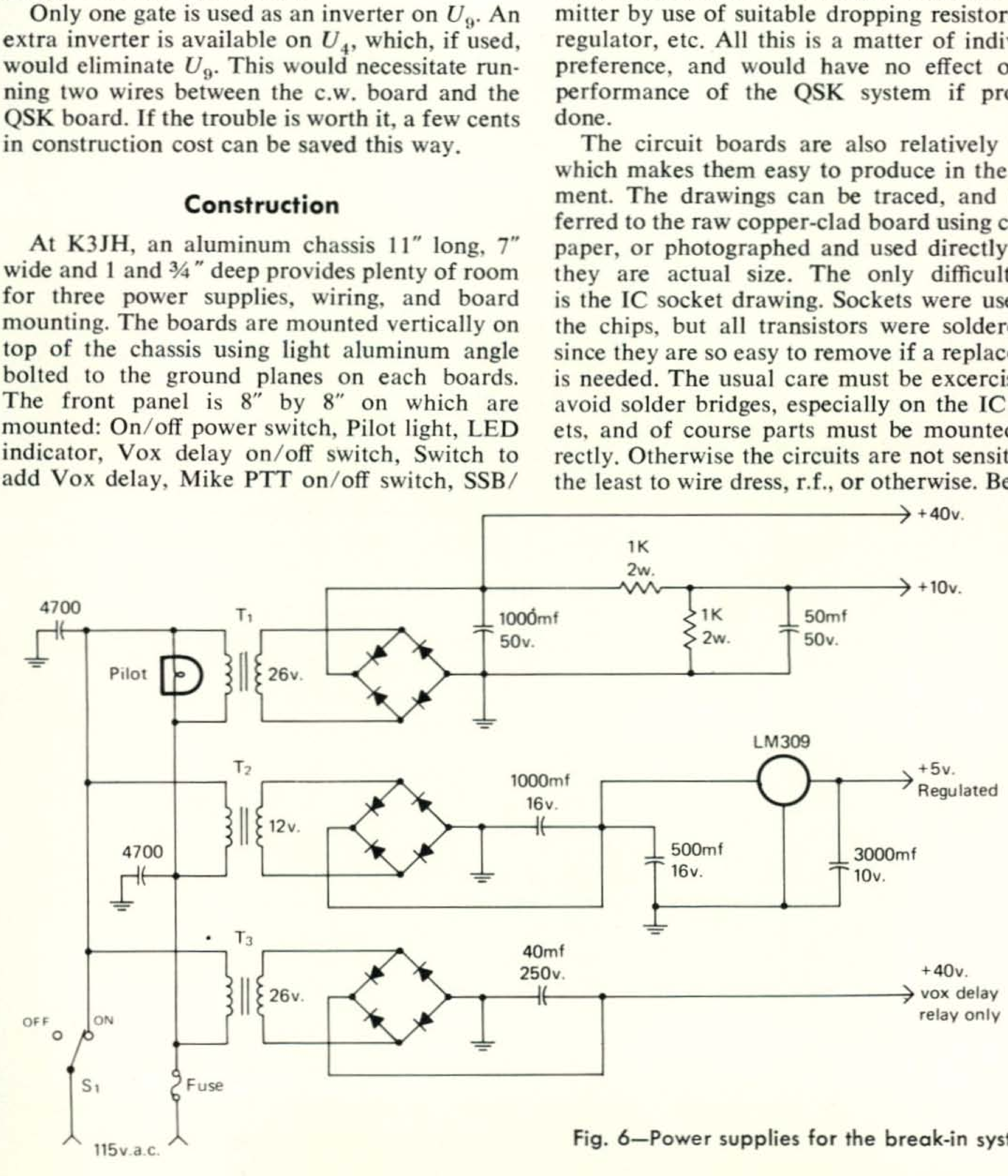

Fig. 6—Power supplies for the break-in system.

Parts Information

Q_1, Q_2—2N5130 or Motorola HEP 56.

Q_3, Q_5, Q_7, Q_9—Motorola HEP 712 or Radio Shack RS2012.

Q_4—Motorola HEP 706 or Radio Shack RS2008.

Q_6—Motorola HEP 716.

Q_8—Radio Shack RS2030.

U_1, U_2—74123.

U_3, U_4, U_9—7400.

U_5—LM3900 Quad Amp. National Semiconductor. (Sometimes hard to find. Available from Kierluff Electronics, 5 Industrial Drive, Rutherford, NJ 07070. $1.05 each, minimum order $10.)

U_6—Radio Shack 7413.

U_7, U_8—74122.

Diodes—All signal diodes are 1N914's or similar types.

Relays—HG1017 mercury wetted relays, double pole, double throw to single common terminal, 5000 ohm coil. Available from Herbach and Rademan, 401 East Erie Ave., Philadelphia, PA 19134. H&R #TM20K111, 6 pieces for $9.00.

For latest information on the availability of HS-1 vacuum relays, send s.a.s.e. to the author, K3JH.

however, to include all bypass capacitors shown on the schematic, to avoid r.f. problems.

Adjustments

The only adjustment to be made for s.s.b. operation is of the keying relay pot, which is connected to terminal 15 of U_1. To adjust this pot, throw the switch, which shorts this pot in the c.w. mode, to s.s.b. Put the transmitter on s.s.b., adjusted for normal operating output. Start at maximum resistance, talk into the mike, which should result in heavy clicks in the receiver output. Keep talking, and slowly reduce resistance. A point will be reached where the clicks disappear. If you continue to reduce the resistance further beyond this point, the keying relay to the transmitter will begin to chatter. If you can not hear any chatter, and the relay closes quite positively, you have the proper adjustment on the pot. Then check with someone on the air, preferably someone who can disable the receiver a.g.c. If any flutter or break-up is reported, the relay needs to be backed off slightly to eliminate it. This may necessitate a slight readjustment of the mute pot to eliminate the last vestiges of any clicks. When operating properly, there is no trace of click in your receiver, and the keying relay closes positively with no chatter, and you will get a clean report on flutter or break-up from your outside observer.

The anti-vox pot is relatively insensitive, since the quad amplifier will saturate the Schmitt trigger with just a slight amount of anti-vox gain turned on. The vox gain pot, however must be adjusted properly for proper operation. At K3JH, turning this pot from full counter clockwise to full clockwise does the following. Moving the pot from full off to 8:30 results in transmitter triggering when you speak into the mike. At 8:30, however, the audio is clipped quite badly. At 9:00 the clipping is reduced but will still be noticeable. At 9:30 the clipping is almost entirely gone, and break-in is still good. From 10:00 on the clipping is gone, but the relays tend to hold longer, and QSK is degrading rapidly. By 12:00 QSK is almost out completely, and the relays hold in most of the time, and the same is true for the rest of the clockwise rotation. Of course different pot tapers will change these readings a bit. It can be seen, however, that the pot settings are not highly critical. A setting at about 9:00 or 9:30 seems to give best results. A little experience makes you an expert at this adjustment. Remember though, if you get a clipping report, it probably is due to a slow a.g.c. in the other guys receiver, and not your transmitter,

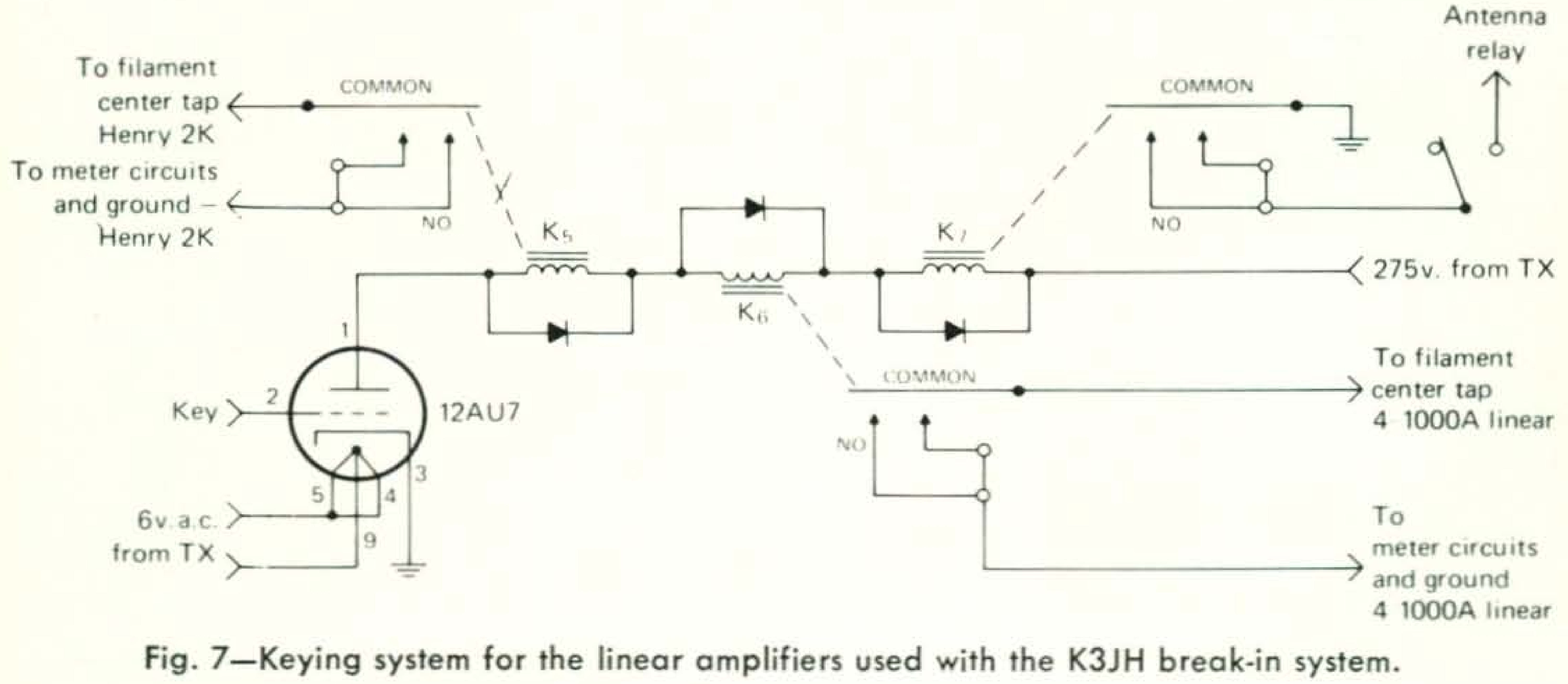
To filament center tap Henry 2K
To meter circuits and ground – Henry 2K
COMMON
NO
K5
K6
K7
COMMON
NO
Antenna relay
275v. from TX
COMMON
NO
To filament center tap 4 1000A linear
To meter circuits and ground 4 1000A linear
1
2
3
4
5
9
Key
12AU7
6v. a.c. from TX

Fig. 7—Keying system for the linear amplifiers used with the K3JH break-in system.

if the adjustments are correct as outlined here. This had the writer fooled for some time until we found the a.g.c. problem is some receivers.

Up to this point, no consideration or effort has been given to adapting the QSK system to transceivers. As indicated before, the system should be usable with any separate transmitter and receiver combination as long as the recommended modifications are accomplished. A TR4 at K3JH will be checked in the near future to see if QSK on s.s.b. is feasible.

Conclusions

With a few exceptions, most of the parts used in the unit are readily available. Whatever can be scavenged from the junk box will reduce out

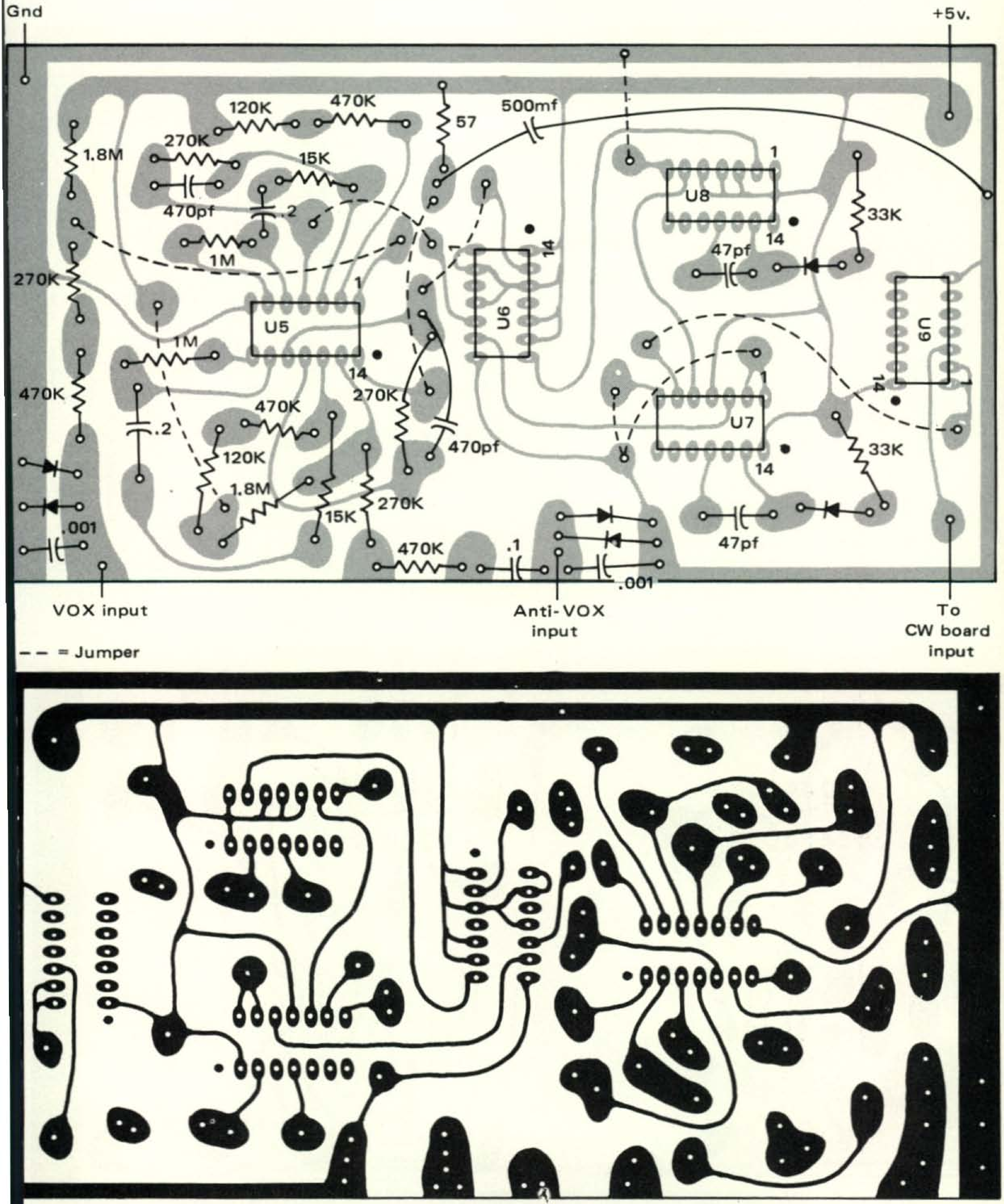
Gnd
+5v.
120K
470K
57
500mf
270K
1.8M
15K
470pf
.2
1M
1
U8
33K
47pf
14
U6
14
1
270K
U5
1M
14
270K
470K
U9
14
1
470K
.2
120K
470pf
U7
1
33K
1.8M
14
15K
270K
.001
470K
.1
47pf
.001
VOX input
Anti-VOX input
To CW board input
– – = Jumper

Fig. 8—P.C. board layout and parts placement for the QSK board, shown full size.

of pocket expense to build the device. Including a surplus antenna relay, the cost to build the QSK should be less than $100, possibly as low as $50 without power supplies and vox relays. A list of ICs and transistors, and a few less readily available parts, is given, along with a few sources of supply.

In conclusion, thanks are due to W0IP and W6RM for their assistance during this project. Anyone who modifies their equipment for this mode of operation, and experiences the pleasure to be derived from it, will always be especially thankful to W0IP for his original pioneering

[*Continued on page 76*]

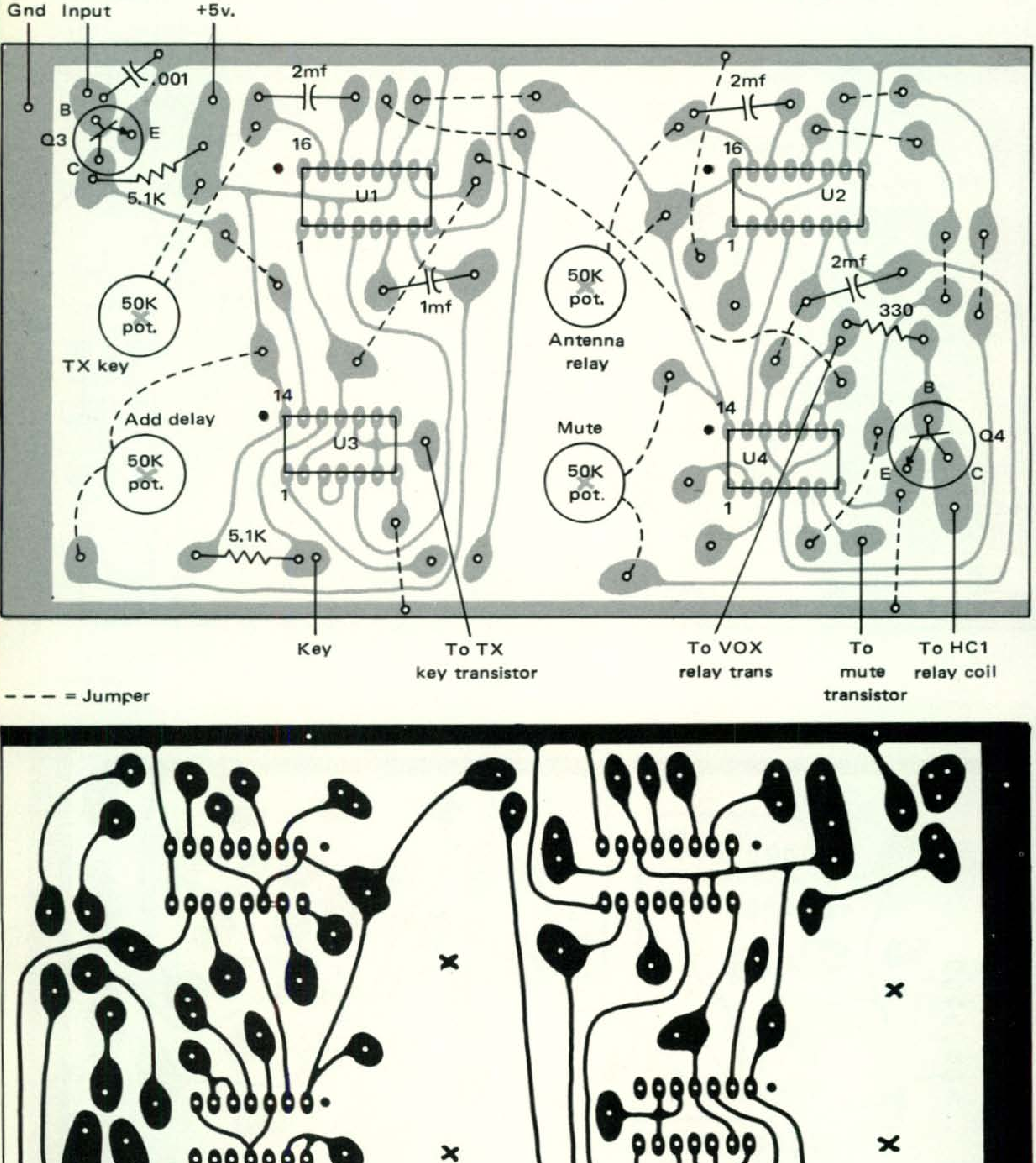
Gnd
Input
+5v.
.001
2mf
B
Q3
E
C
5.1K
16
U1
1
50K pot.
TX key
1mf
14
Add delay
U3
50K pot.
1
5.1K
Key
To TX key transistor
2mf
16
U2
1
2mf
50K pot.
Antenna relay
330
B
Q4
E
C
14
Mute
50K pot.
U4
1
To VOX relay trans
To mute transistor
To HC1 relay coil
- - - = Jumper

Fig. 9—C.w. board P.C. layout and parts placement.

The "Gray Line" Method of DXing

Exotic 80-meter DX without a giant antenna or without losing sleep.

BY DALE HOPPE, K6UA AND PETER DALTON, W6NLZ
EDITED BY FRED CAPOSSELA,* K6SSS

Just like a lot of people, we used to think that working DX on 80 meters took giant antennas and a giant case of insomnia.

That is, we used to. Until a couple of years ago. When we discovered a propagation phenomenon called the "Gray Line."

17,000 Mile DX

We've been experimenting with the "Gray Line" for several years now. And it's been our pleasure from the Southern California area to work SM5SB, 3B8AX, ET3USE, 4S7PB, OH1XX and dozens others on 3.795 MHz s.s.b. —all on the "Gray Line." We're not the only ones to do it. A number of others have too (fig. 1).

Exactly what it is? The best way to describe the "Gray Line" is to say that it is a long path opening that exists between two points on the earth which are experiencing simultaneous sunrise and sunset, or vice-versa.

The signals travel along the edge of the band or ring of twilight encircling the earth (fig. 2).

What It Can Do For You

Once you know how, you can use the "Gray Line" table to:

—predict the exact DX you can work during any time of the year on 80.

—achieve success with an antenna no fancier

Stations	Date	GMT	Antennas
9M2DW—K2RBT	Jan. 2, 1967	2201	Dipole 40 ft. (13m.)/pair $\frac{1}{4}\lambda$ verticals
VK6HD—W1GL	July 5, 1971	2355	Dipole 60 ft. (20m.)/invert. vee 30 ft. (10m.)
XV5AC—W2IWC (hrd.)	Oct. 28, 1972	2346	Unknown/invert. vee 33 ft. (11m.)
UL7GW—WA2FCA	Nov. 26,1972	1159	Unknown/invert. vee 90 ft. (30m.)
EP2BQ—W6NLZ	Dec. 18, 1972	1454	Dipole 50 ft. (16m.)/2el. ZL Special 75 ft. (25m.)
LA9YF—W6NLZ	Feb. 3, 1973	1435	Sloping dipole/2el. ZL Special 75 ft. (25m.)
MP4BJS—W6NLZ	Jan. 28,1974	1423	18AVT/2el. ZL Special 75 ft. (25m.)
OJ0AM—W6NLZ	Jan. 28, 1974	1457	$\frac{1}{4}\lambda$ vert./2el. ZL Special 75 ft. (25m.)
OH5VT—K6UA	Feb. 5, 1974	1442	$\frac{1}{4}\lambda$ vert./2el. Quad 100 ft. (33m.)
SM5SB—K6UA	Feb. 5, 1974	1454	Invert. vee 120 ft. (40m.)/(33m.)
SM5BLA—W6NLZ	Feb. 16, 1974	1450	Sloping dipole/2el. ZL Sp. 75 ft. (25m.)
3B8AX—K6UA	Feb. 17, 1974	1445	Long wire 25ft. (8m.)/2el. Quad 100ft. (33m.)
AP2AD—W6NLZ	Mar. 20, 1974	1410	$\frac{1}{4}\lambda$ vert./2el. ZL Sp. 75 ft. (25m.)
VS6DO—WB2FZO	Aug. 28, 1974	1030	Dipole atop 200 ft. (65m.) bldg./unknown
VS6DO—KP4AST(hrd.)	Sep. 1, 1974	1030	Dipole atop 200 ft./vee beam 90 ft. (30m.)
TU2DO—K6SEN/KX6	Sep. 5, 1974	0600	18AVQ/Vert. dipole
OZ5KF—W6NLZ	Oct. 30, 1974	1429	Dipole 165 ft. (55m.) 2el. ZL Sp. 75 ft. (25m.)
4X4NJ—K6UA	Nov. 16, 1974	1433	18AVT/2el. Quad 100 ft. (33m.)
UL7GW—W4QCW	Nov. 30, 1974	1158	Unknown/invert. vee 60 ft. (20m.)
VU2GDG—W6NLZ	Dec. 16, 1974	0041	Invert. vee 60 ft. (20m.)/invert. vee 75 ft. (25m.)
4S7PB—K6UA	Dec. 20, 1974	0110	Dipole 45 ft. (15m.)/2el. Quad 100 ft. (33m.)
ET3USE—K6UA	Jan. 10, 1975	1437	Dipole 35 ft. 12m.)/2el. Quad 100 ft. (33m.)
9K2DC—W6NLZ	Jan. 13, 1975	1445	Dipole 20 ft. (6m.)/2el. ZL Sp. 75 ft. (25m.)
GC2FMV—KS6DH	Feb. 3, 1975	0623	Unknown/dipole 40 ft. (13m.)

Fig. 1—Verified 80-meter "Grayline" QSOs (partial list).

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*c/o *CQ*, 14 Vanderventer Ave., Port Washington, N.Y. 11050.

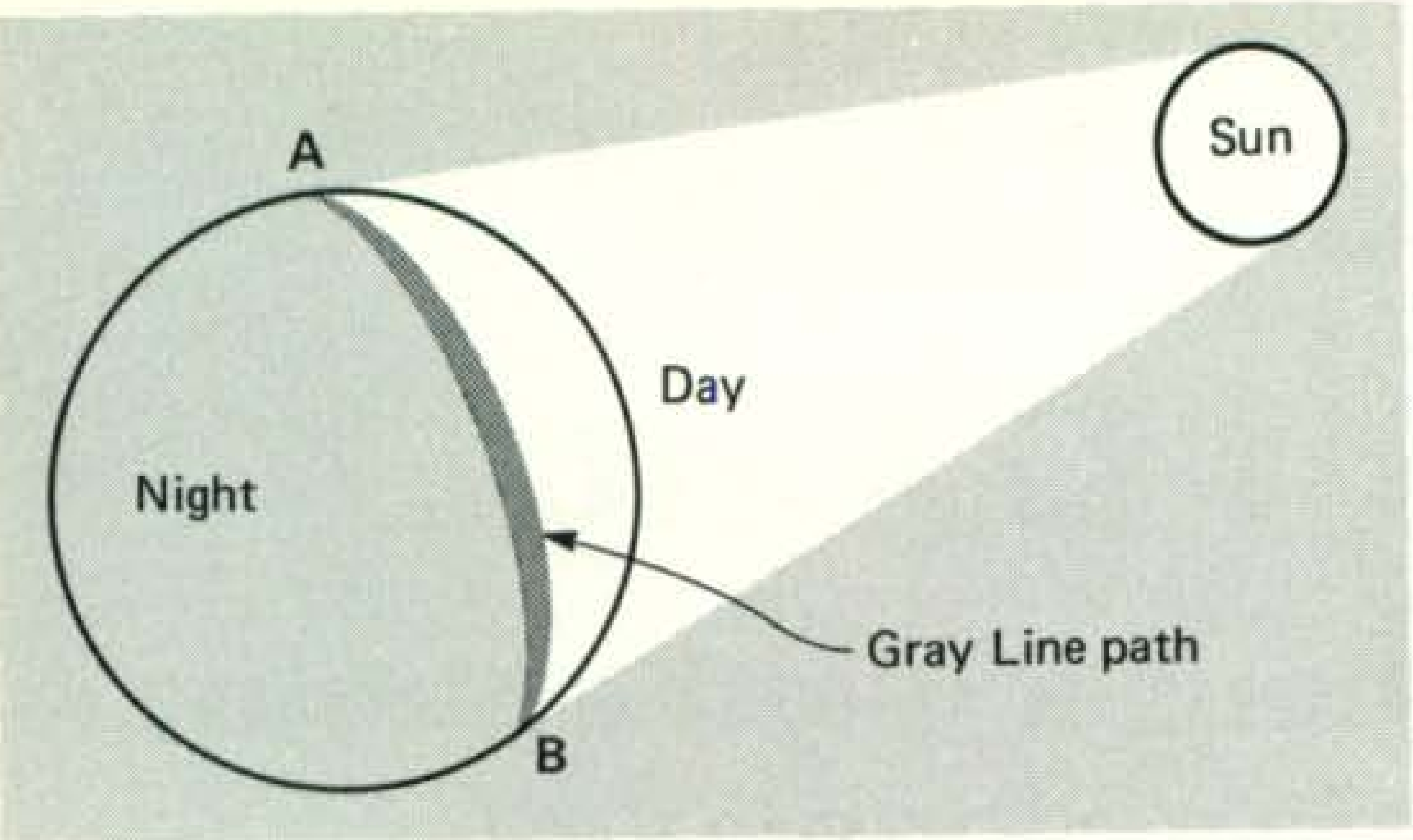


Fig. 2—The Gray Line. Long path opening is likely at twilight between points A and B.

than an 80-meter dipole. (Of course, the old adage "the bigger, the better" still holds.)

——and best of all, do it without having to lose sleep.

In astronomical terms the "Gray Line" is technically called the terminator. Because it separates the light side of the planet from the dark side.

When To Use It

The "Gray Line" is in effect two hours a day. One hours in the morning—plus or minus 30 minutes from sunrise. And one hour in the evening—plus or minus 30 minutes from sunset.

If you'd like to see what DX you might work on any given day, all you need are three things:

1. The Gray Line Table (fig. 7).
2. A globe (any one will do, even the kind used for children's coin banks)
3. A piece of cardboard slightly larger than your globe.

"Bending" A Few Rules

We can really simplify everything if we take a few liberties with Copernican theory and "bend" some basic rules of astronomy.

Simply "pretend" that:

1. The earth is the center of the universe, so that . . .
2. The sun "travels" around our planet once a year.
3. And that the earth's axis which passes through the North and South poles is perfectly vertical (0°).

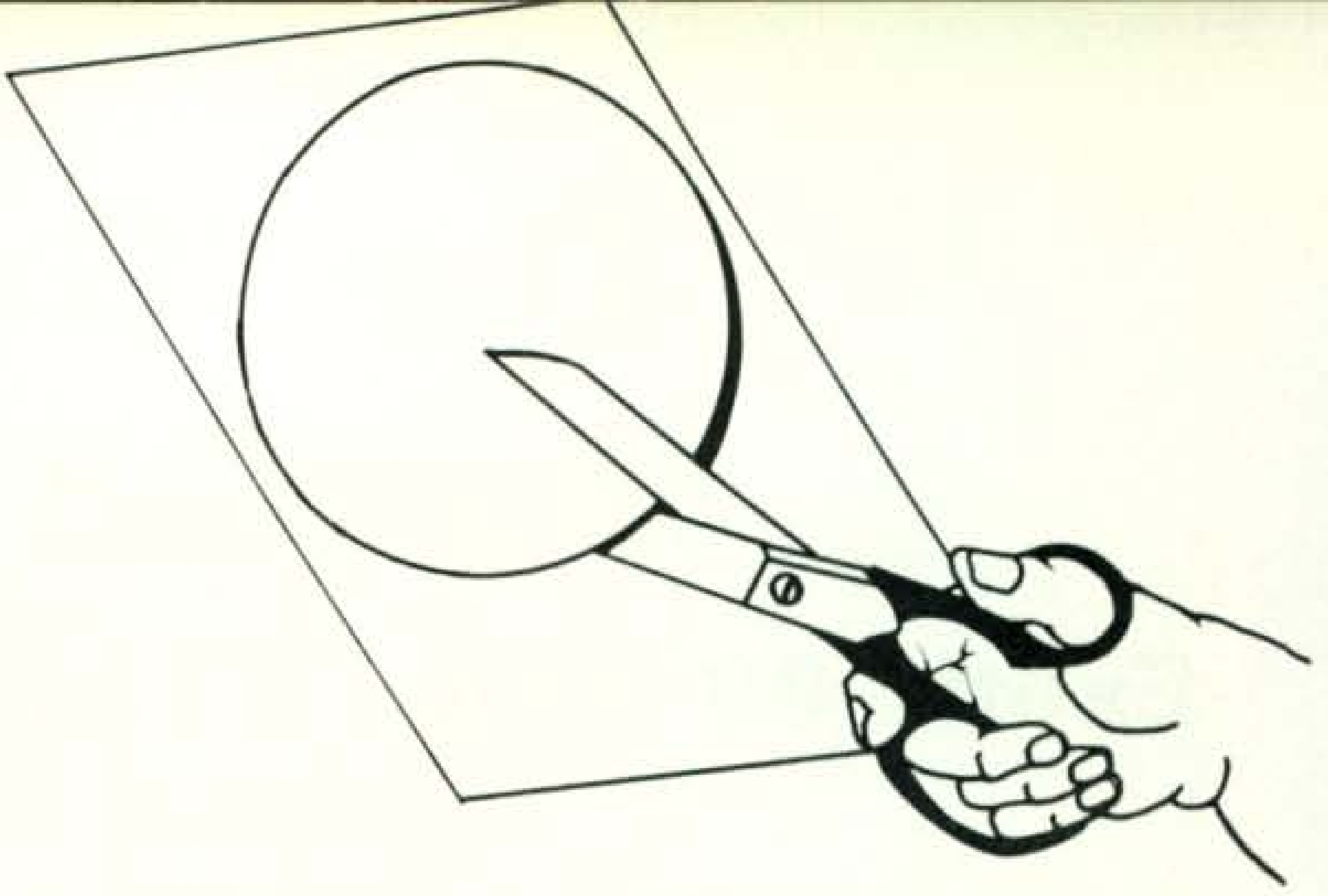


Fig. 4—Cut circle in cardboard to match globe.

Now, looking at fig. 3A you can see that the sun "travels" a maximum of 23 degrees North (fig. 3B) and 23 degrees South (fig. 3C) of the Equator on its annual journey between the Tropic of Cancer and the Tropic of Capricorn. Since the Sun is going north on one trip and south on the other, that means that it will cross the Equator twice a year—approximately March 21 and September 21—called Equinoxes.

Morning Gray Line (Sunrise)

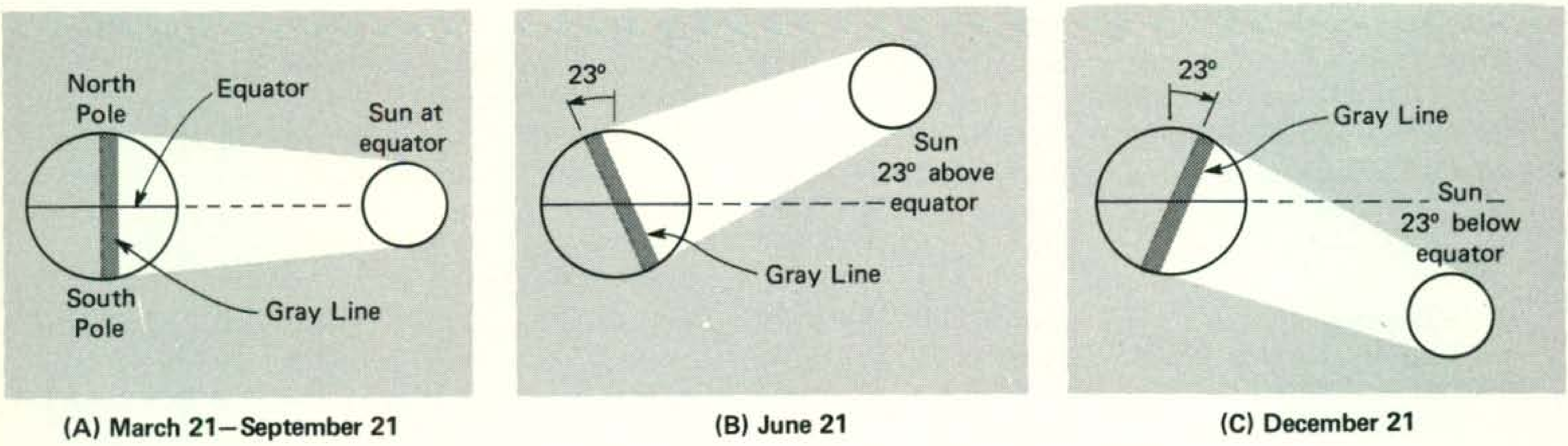
Cut out a circle from your cardboard to match the diameter of your globe (fig. 4). Don't cut too much. Make sure the globe fits snugly into the hole in the cardboard. Congratulations, the cardboard has just become your Gray Line Indicator (fig. 5).

Now, align your cardboard Indicator approximately on your globe using the Gray Line Estimator (sunrise) (Fig. 6A). This will get you to within a few degrees for the morning (sunrise) period.

To find the exact Gray Line path adjust the cardboard Indicator to the degree given for today's date in the Gray Line Table (fig. 7) Then rotate the globe until the cardboard Indicator slices through your home town. You're now on the Gray Line.

A Handy Trick

A trick (fig. 8) to help you calibrate your globe at home is to think of the North Pole as 0 degrees (rather than 90 North) and the Arctic Circle 23 degrees (rather than 67 North). The



(A) March 21—September 21 (B) June 21 (C) December 21

Fig. 3—The sun's relative angle to the earth's equator varies throughout the year.

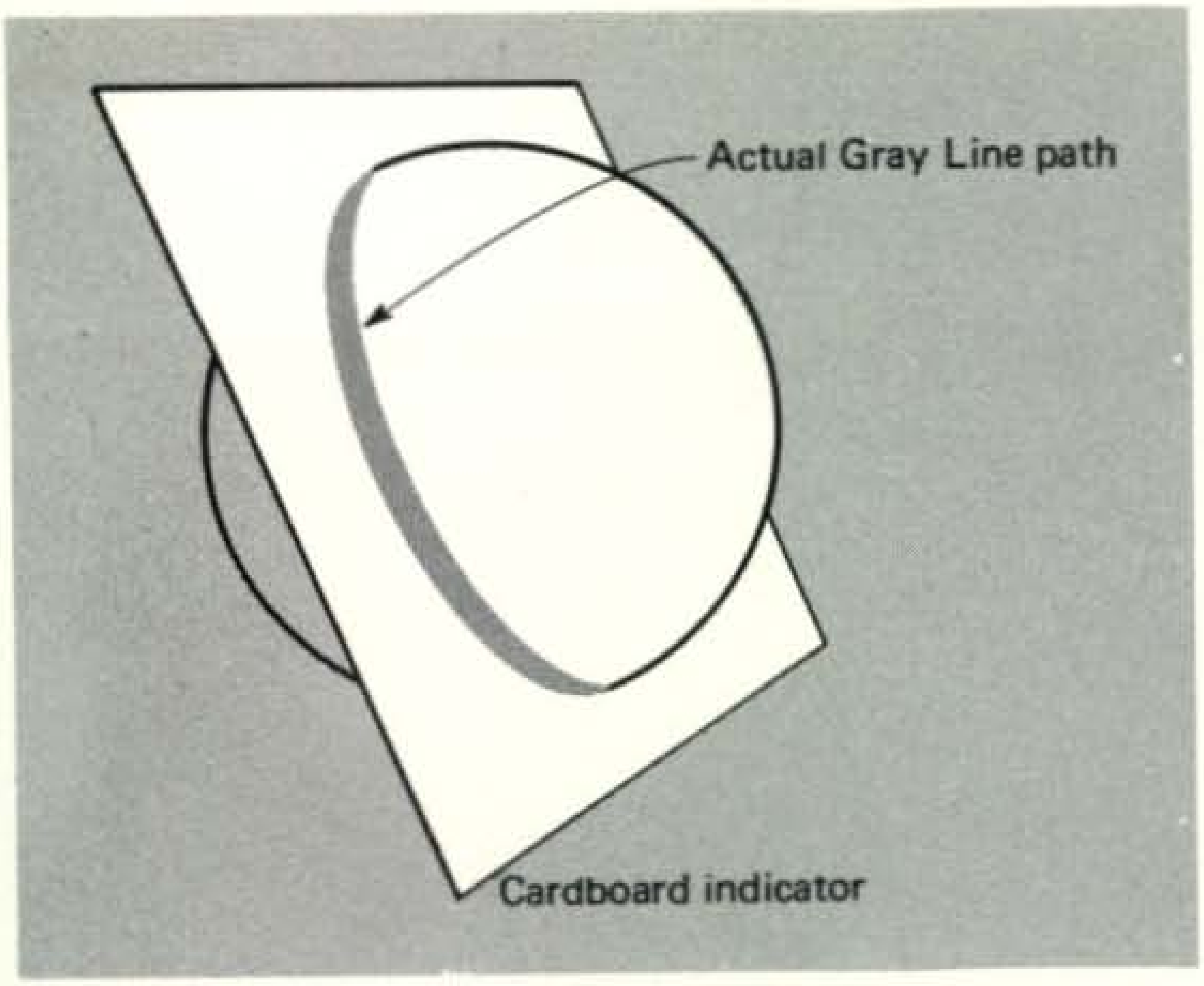


Fig. 5—Cardboard Gray Line Indicator.

Arctic Circle is usually represented by a dotted ring on most globes. This will give you the two limit points that your cardboard Indicator will swing between. Next, convert the other two high latitude rings (80 and 70 North) to 10 and 20 degrees. And you've got all the reference points you really need to calibrate the Gray Line path.

Once you've got your cardboard Indicator on the Gray Line over your QTH, run your finger down around to the other side of the world. All the DX that your cardboard cuts through is what you're in a position to work on that day. That is, at your sunrise. We'll talk about sunset in a minute.

For Example

Let's say it's December 21st and you live in San Francisco, California. What can you work this morning on the sunrise Gray Line?

From the Gray Line Table (fig. 7), you'll set your cardboard at 23 degrees South. And move the globe until it's over your town. Now run your finger down across the Pacific Ocean. And you'll see that the Gray Line comes up through 5R8 and 5Z4, between I and ZA, and continues all the way up to PA0.

Evening Gray Line (Sunset)

That's fine. But what happens in the evening at sunset? Can you work the same things you did this morning? Absolutely not.

You plot the Gray Line the same way, or course. However, use the evening Gray Line Estimator (fig. 6B). But once you get the exact degree from the Gray Line Table (fig. 7), you *must do* one very important thing—*reverse* North and South.

Instead of setting your cardboard at 23 degrees South for December 21st (as you do in the morning), you would set your cardboard at 23 degrees North for the sunset Gray Line.

Running your finger down from San Francisco this time, you'll see that you're crossing Mexico's Baja California Peninsula and the southern tip of South America. Through 4S7. And all the way up to A51 and JT1. Which certainly is a different Gray Line from the one you plotted this morning.

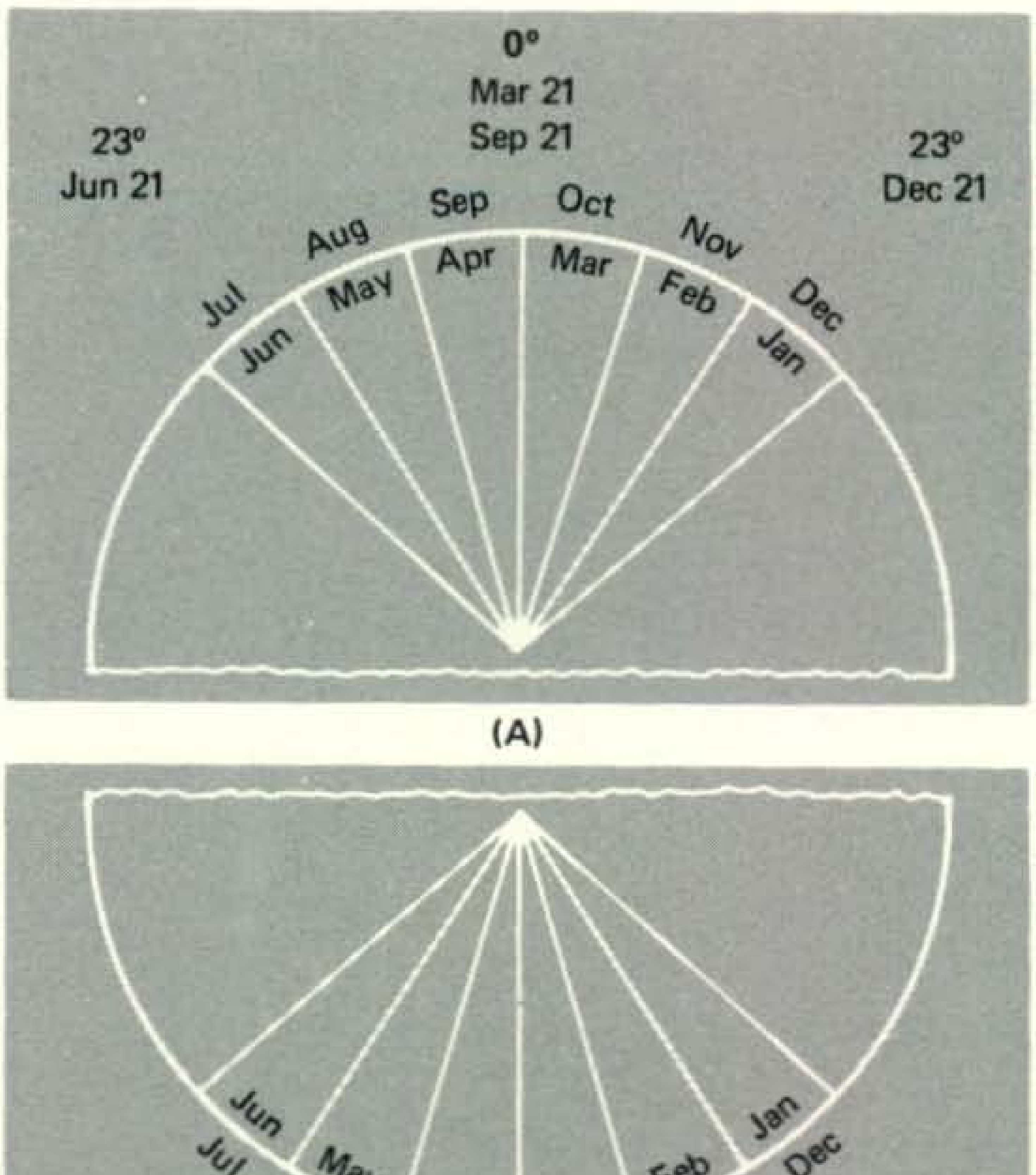
Using the Gray Line you'll be able to find the exact days or weeks that the "window" is open for you to work certain points on the earth. You can set up skeds months in advance, because you'll know when to spend your time working on antennas, and when to spend it on the Gray Line. The Gray Line puts you at the right place at the right time.

Your Gray Line Reports Welcomed

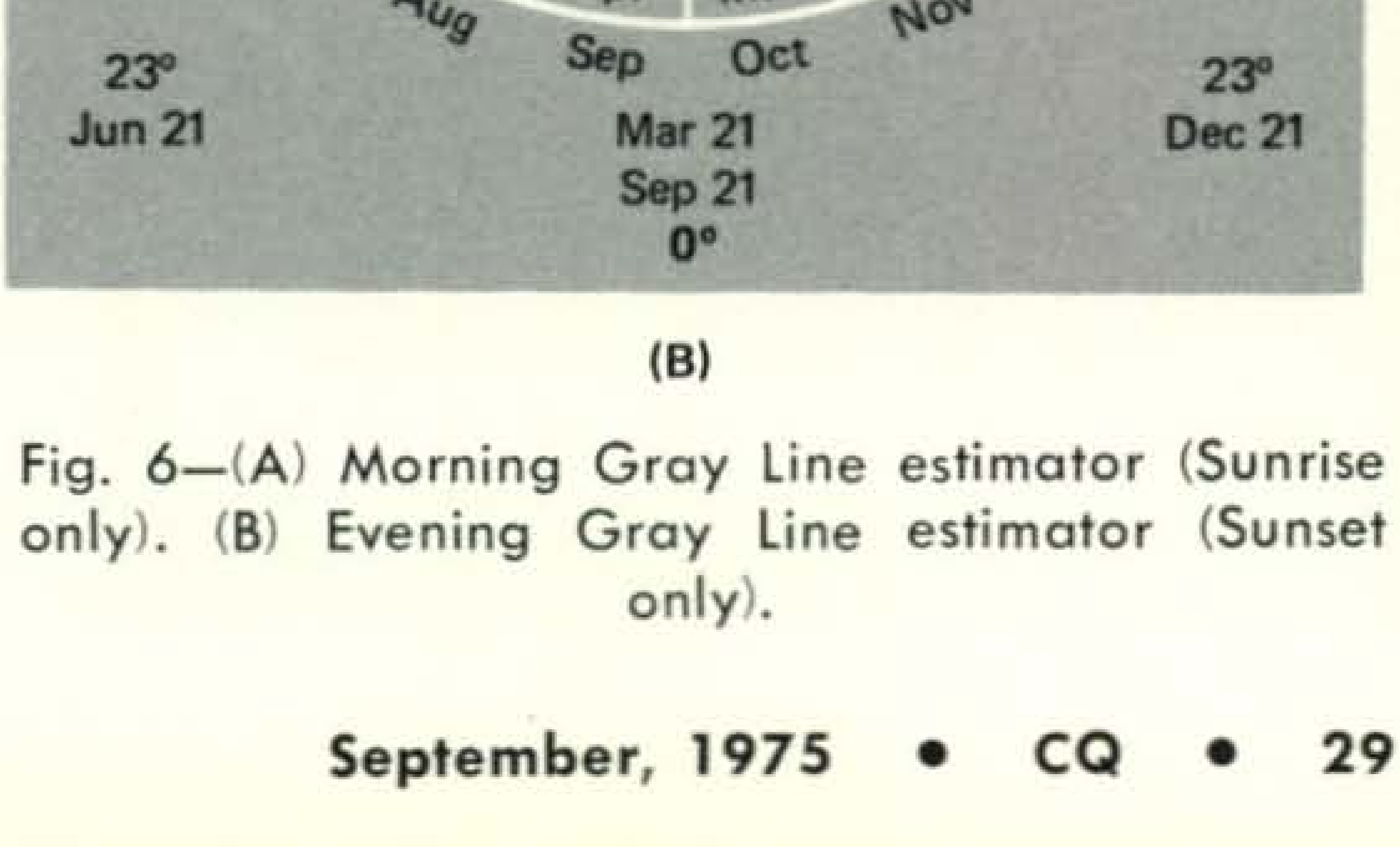
By the time this appears in print, K6UA will be living in the Washington, D.C. area prior to an overseas assignment with the U.S. Government. So he hopes to continue his Gray Line experimenting for W3-land. And he's really looking forward to doing it in a big way when he gets overseas.

Daily Gray Line From California

Although K6UA won't be able to join them, there will be two stations on the West Coast—K6SSS and W6NLZ—calling "CQ GRAY LINE" between 1400 and 1500 GMT this season on 3.795 MHz every day looking for Europe,



(A)

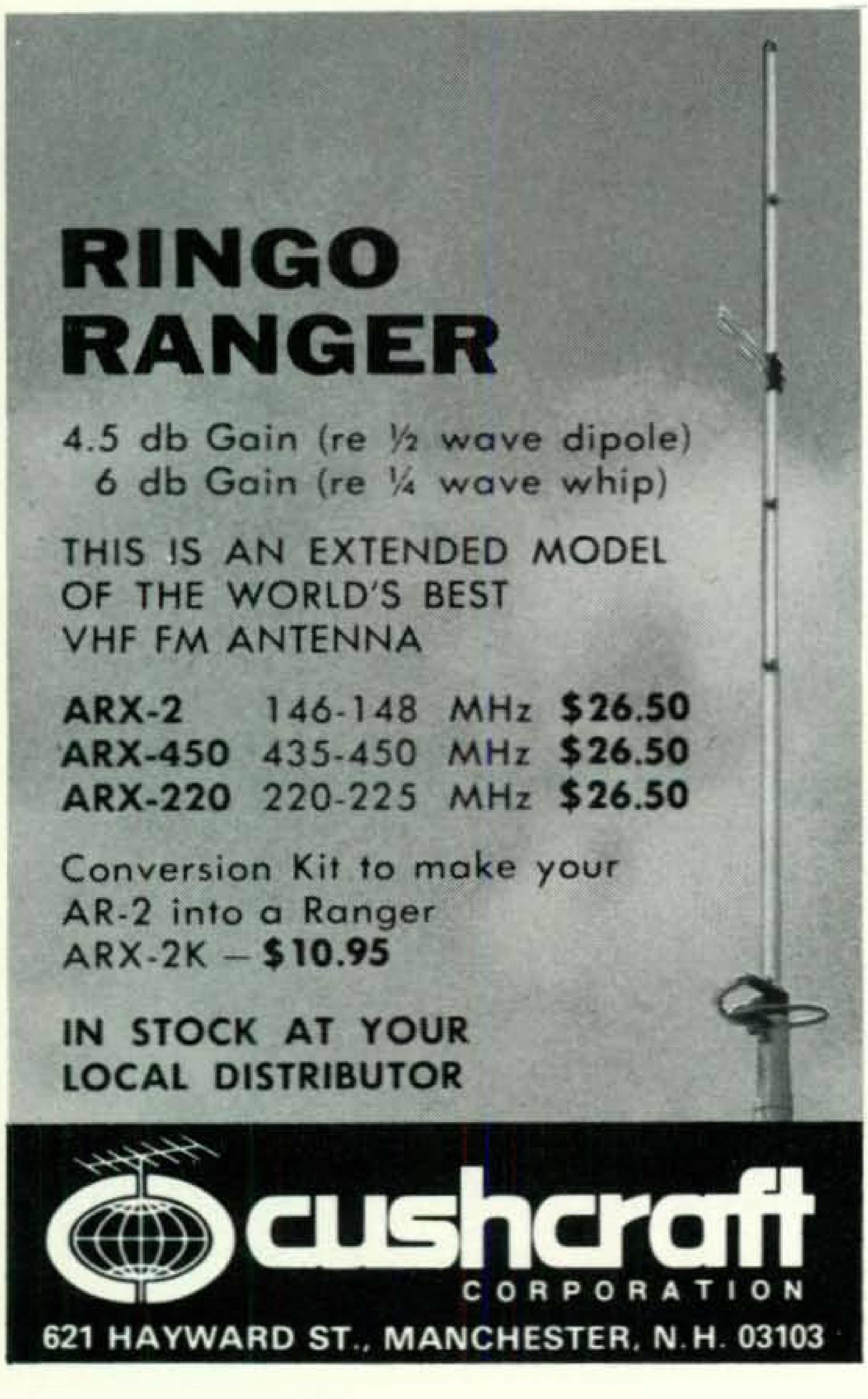


(B)

Fig. 6—(A) Morning Gray Line estimator (Sunrise only). (B) Evening Gray Line estimator (Sunset only).

Month/Day	Angle	Month/Day	Angle	Month/Day	Angle	Month/Day	Angle
Jan. 1	23°S	Mar. 26	1°N	Jul. 3	22°N	Sept. 26	1°S
Jan. 2	23°S	Mar. 29	2°N	Jul. 12	21°N	Sept. 28	2°S
Jan. 10	22°S	Mar. 31	3°N	Jul. 19	20°N	Oct. 1	3°S
Jan. 16	21°S	Apr. 3	4°N	Jul. 24	19°N	Oct. 4	4°S
Jan. 21	20°S	Apr. 5	5°N	Jul. 28	18°N	Oct. 6	5°S
Jan. 25	19°S	Apr. 8	6°N	Aug. 2	17°N	Oct. 9	6°S
Jan. 29	18°S	Apr. 11	7°N	Aug. 5	16°N	Oct. 11	7°S
Feb. 2	17°S	Apr. 13	8°N	Aug. 9	15°N	Oct. 14	8°S
Feb. 5	16°S	Apr. 16	9°N	Aug. 12	14°N	Oct. 17	9°S
Feb. 8	15°S	Apr. 19	10°N	Aug. 16	13°N	Oct. 20	10°S
Feb. 12	14°S	Apr. 22	11°N	Aug. 19	12°N	Oct. 22	11°S
Feb. 15	13°S	Apr. 25	12°N	Aug. 22	11°N	Oct. 25	12°S
Feb. 18	12°S	Apr. 28	13°N	Aug. 25	10°N	Oct. 28	13°S
Feb. 20	11°S	May 1	14°N	Aug. 28	9°N	Oct. 31	14°S
Feb. 23	10°S	May 5	15°N	Aug. 31	8°N	Nov. 3	15°S
Feb. 26	9°S	May 8	16°N	Sept. 2	7°N	Nov. 7	16°S
Feb. 28	8°S	May 12	17°N	Sept. 5	6°N	Nov. 10	17°S
Mar. 3	7°S	May 16	18°N	Sept. 8	5°N	Nov. 14	18°S
Mar. 6	6°S	May 21	19°N	Sept. 10	4°N	Nov. 18	19°S
Mar. 8	5°S	May 26	20°N	Sept. 13	3°N	Nov. 22	20°S
Mar. 11	4°S	Jun. 1	21°N	Sept. 16	2°N	Nov. 27	21°S
Mar. 13	3°S	Jun. 10	22°N	Sept. 18	1°N	Dec. 3	22°S
Mar. 16	2°S	Jun. 21	23°N	Sept. 21	0°	Dec. 12	23°S
Mar. 18	1°S			Sept. 23	0°	Dec. 23	23°S
Mar. 23	0°						

Fig. 7—Gray Line Table for **Sunrise.** For **Sunset** read same angle, but reverse North and South, i.e., September 2 Sunset, the figure is 7° S.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Africa and the Middle East. The authors would be delighted to receive reports of your experiences s.w.l.ing and DXing on the Gray Line. Just mail them c/o *CQ* Magazine.

Many Thanks To One and All

Our deep thanks to the people who made all our experiments possible. Most especially to our XYL's. And to dozens of helpful friends around the world including Karl, SM5SB; Sig. SM5BLA; John, ON4UN and Paul, VS6DO. ■

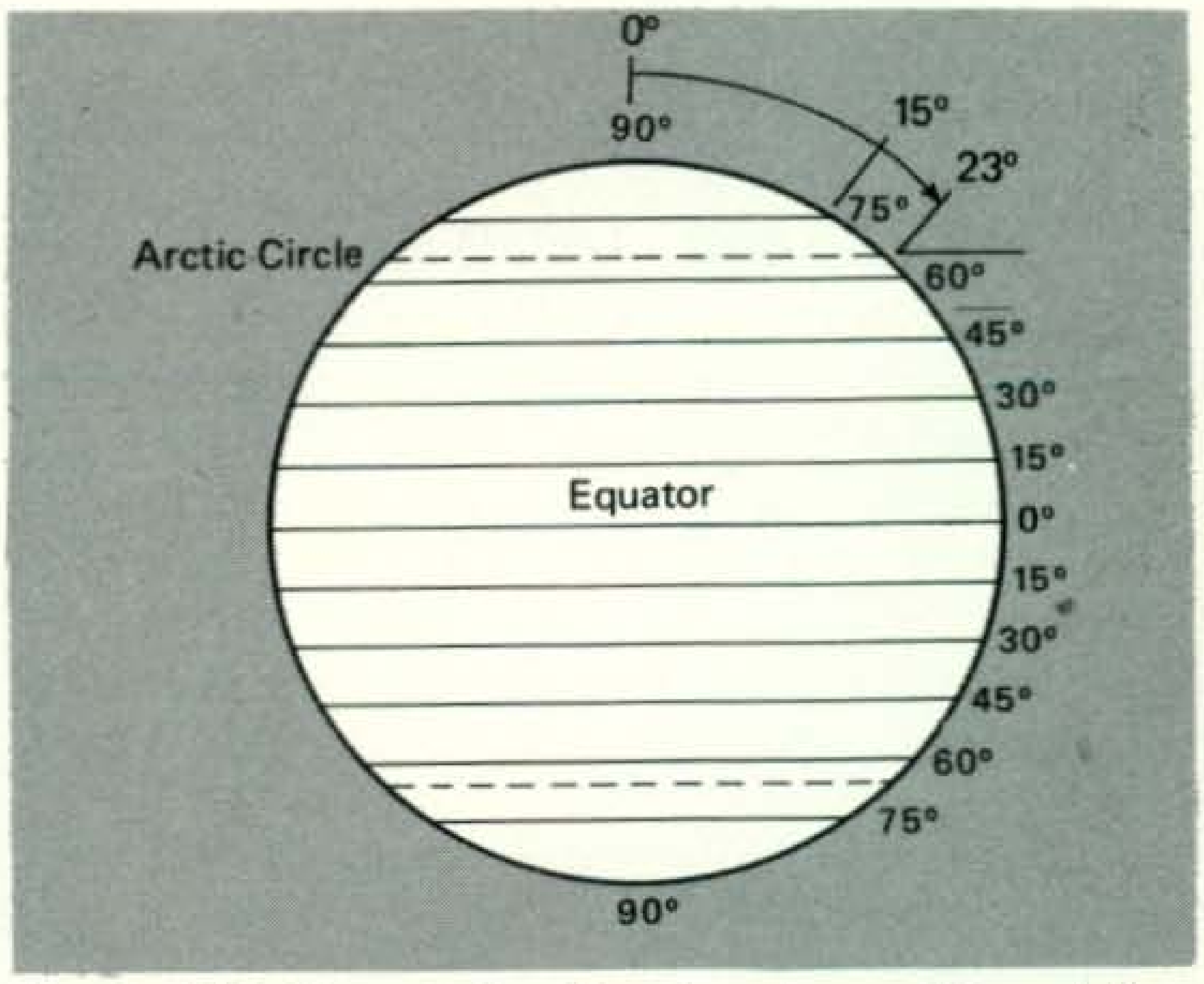


Fig. 8—Thinking of the North pole as 0° and the Equator as 90° simplifies the location of reference points to plot the Gray Line.

A Versatile Secondary Frequency Standard

By EDWARD R. SPADONI,* W1RHN

HAVE you ever wondered how good your dial calibration is on your h.f. tranceiver or receiver, between those 25 kHz or 100 kHz markers? Wished that you could spot 1 kHz on your tranceiver that has only 5 kHz readout? Did you ever need a precision frequency, voltage source with a square wave output for your test bench oscilloscope. Yes, even align the transmit crystals in your 2 meter f.m. tranceiver using your old 2 meter broad-band converter and communication receiver combination. The calibrator to be described was used in all of the above mentioned applications with satisfying results.

Description

The calibrator is portable and completely self contained; it's power is derived from three C size cells for long service. It delivers selected outputs of 100, 20, 10, 5 and 1 kHz, has an LED indicator to remind you to shut off the calibrator after use. The on-off switch has a momentary spot position that comes in handy for quick checks, drift, etc. The output is very rich in harmonics well into the h.f. range, square wave, with a fast rise and fall time. Most parts came from the usual junk box; purchased parts from the local radio-TV store. The intergrated circuits came from my junk box but are readly available. Other similar types can be substituted with little or no change in circuitry. Output is taken from binding posts (handy for scope use) and an SO-239 coaxial connector.

Theory of Operation

A 100 kHz clock signal is generated by the crystal oscillator IC_1 (μL-914) circuit. Half of IC_2 (μL-914) is used as a buffer between the oscillator and the first decade counter IC_3 (7490); it is programmed by the selector switch and used to generate the 10 and 20 kHz output. The second decade counter IC_4 (7490) like the first is programmed to produce 1 kHz and 5 kHz output. Note, IC_4 will draw current only when it is switched into the circuit, Thus saving battery power when not in use.

After adjusting the oscillator to a receiver tuned to WWV the unit will remain stable and calibrated for a long time.

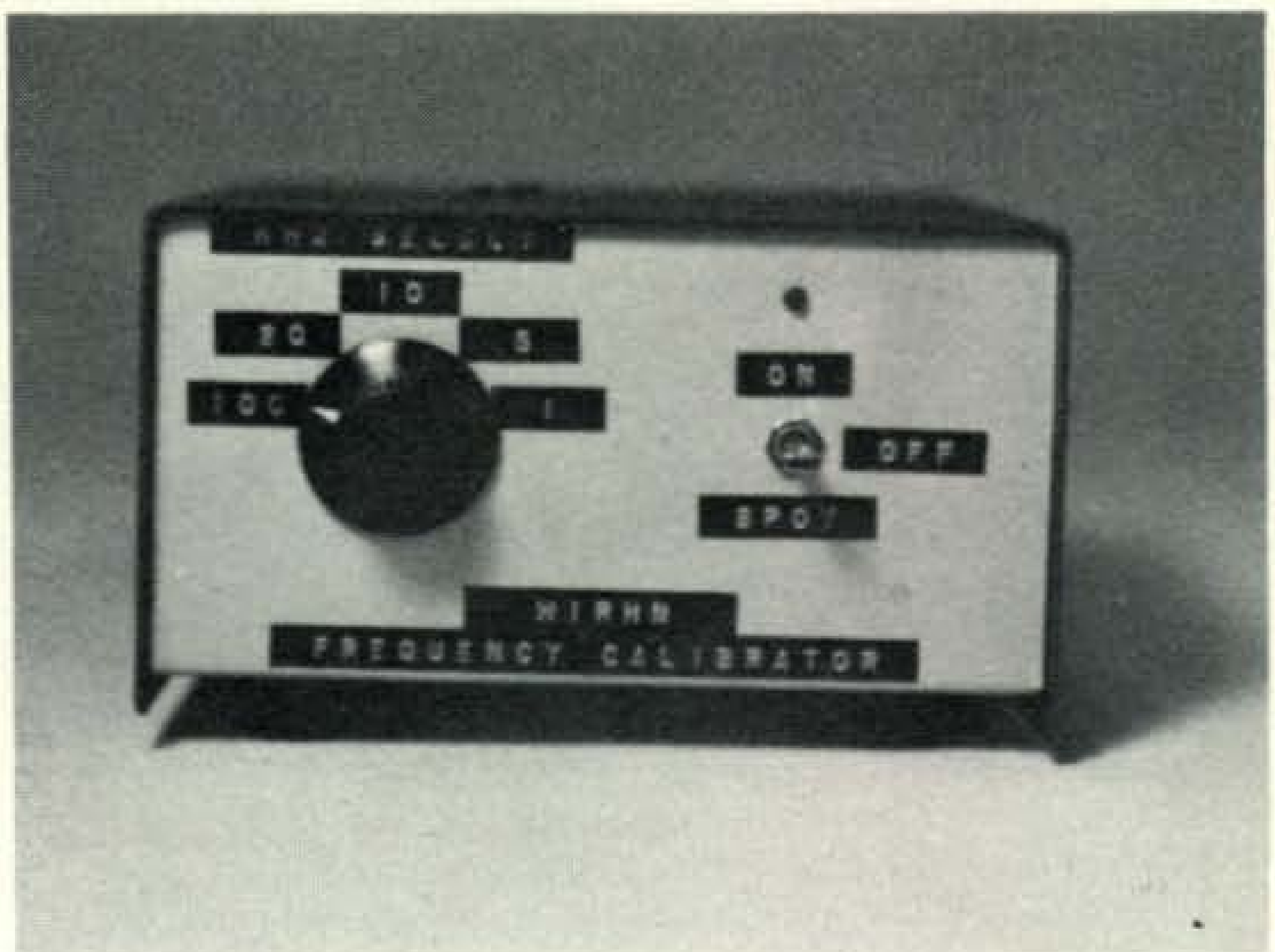
Construction

To maintain good electrical and mechanical stability it is important that good construction practices be used. Make the unit as rigid as practical; *i.e.*, oscillator components on the board should not move with vibration. Perf board with holes on 1/10 inch centers was used to mount most of the components. It also accomodated 14 pin dual inline IC sockets very nicely. Secure the board in each corner with ¼ inch long spacers, 6-32 screws, lockwashers and nuts. The enclosure can be any box or case with approximate dimensions of 4×5×6 inches. The housing that I chose to use was from Radio Shack.

The μL-914 *(IC-IC_2)* integrated circuits were mounted on an Augas #8136-29G1 14 pin lead adapter plug so that an assembly could be made and plugged into a standard 14 pin IC socket. This assembly is optional, the μL-914's can be mounted and wired directly to board if desired. All of the board wiring was done on the underside of the perf board using #22 tinned solid wire and insulated sleeving where necessary.

Use and Adjustment

To adjust calibrator, connect to a receiver that is capable of tuning to one of the WWV frequencies. Loosely couple the calibrator output to the antenna terminals on the receiver so that just enough signal is applied for a good zero beat. Then adjust the zero adj. capacitor



The calibrator is housed in a Radio Shack 3×5¼× 5⅞" steel cabinet.

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*91 Tower St., Dedham, Mass. 02026

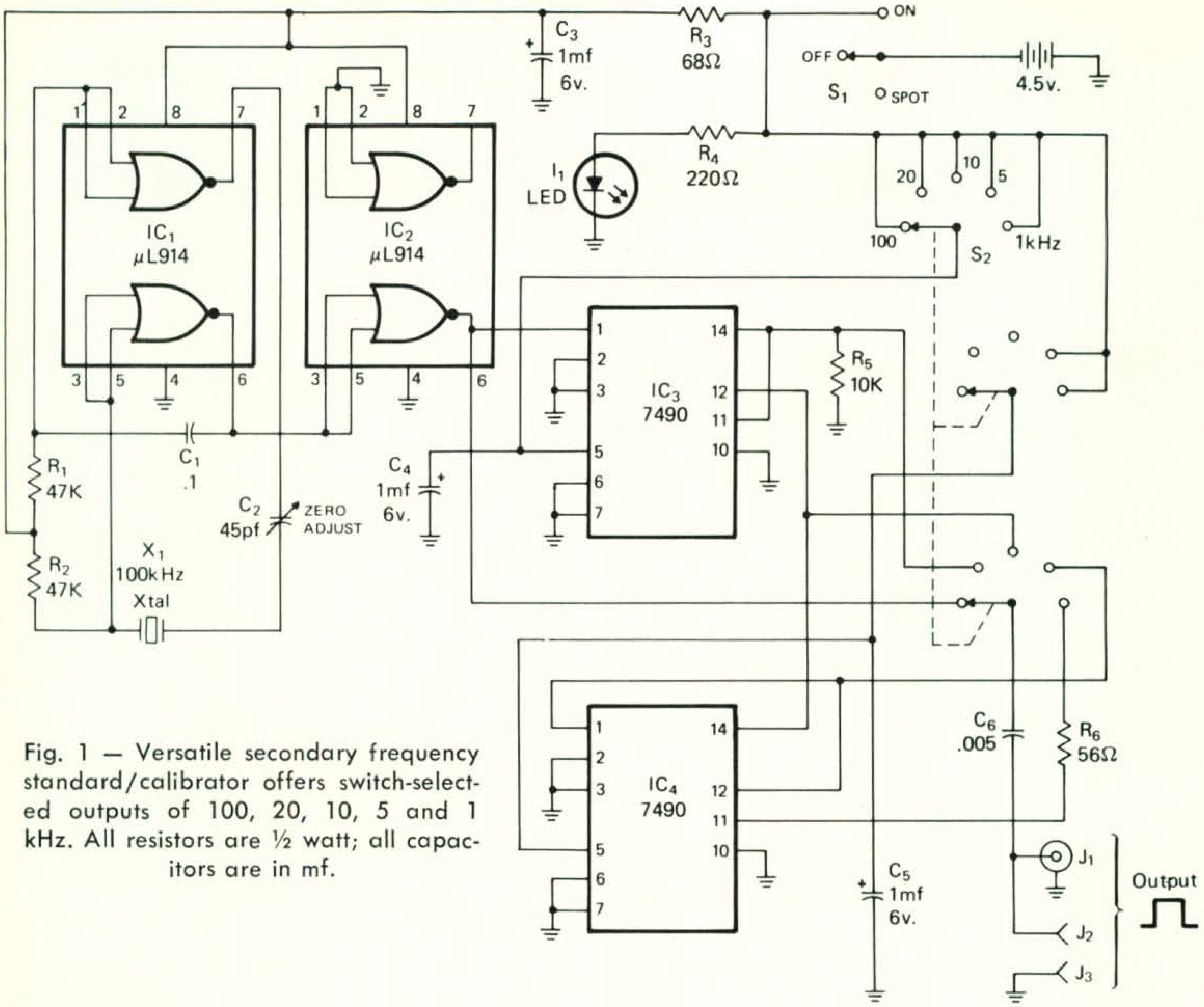
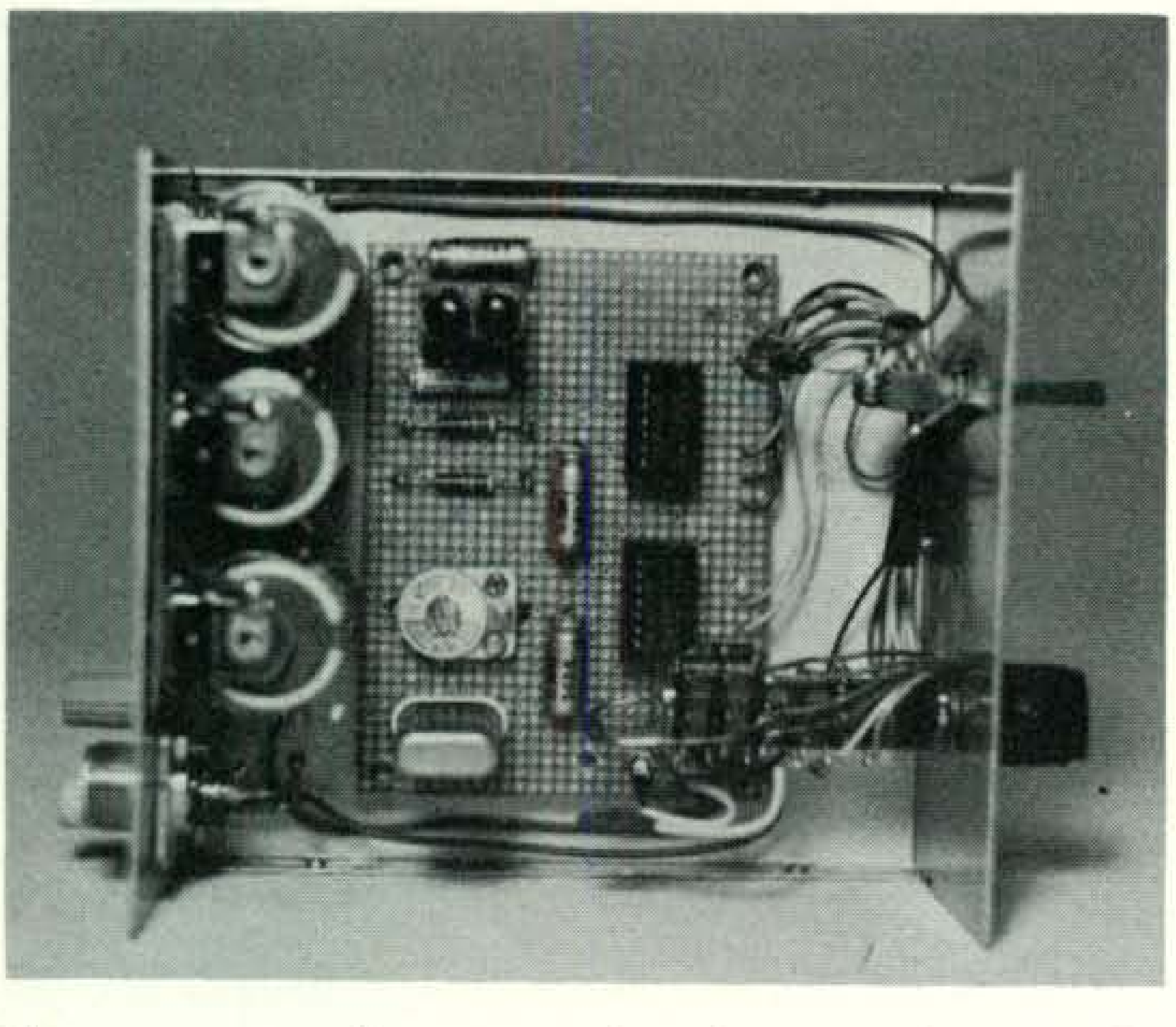

ON
OFF
SPOT
S_1
4.5v.
C_3
1mf
6v.
R_3
68Ω
R_4
220Ω
I_1
LED
20
10
5
100
1kHz
S_2
IC_1
μL914
IC_2
μL914
IC_3
7490
IC_4
7490
R_5
10K
R_1
47K
R_2
47K
C_1
.1
C_2
45pf
ZERO ADJUST
X_1
100kHz
Xtal
C_4
1mf
6v.
C_5
1mf
6v.
C_6
.005
R_6
56Ω
J_1
J_2
J_3
Output

Fig. 1 — Versatile secondary frequency standard/calibrator offers switch-selected outputs of 100, 20, 10, 5 and 1 kHz. All resistors are ½ watt; all capacitors are in mf.

(C_2) in the calibrator and you're finished.

When using with h.f. tranceivers the calibrator output must be connected to the receive side of the antenna change-over relay. When aligning 2 meter f.m. tranceiver transmit crystals, connect the calibrator between the converter and communication receiver antenna terminals. Some communication receiver frequency correction may be required because of possible frequency offset due to the converter crystal tolerance. Correction can easily be made by tuning in a known 2 meter signal such as a repeator and offsetting the b.f.o. on the receiver until zero beat of the f.m. signal is heard. (Some frequency wandering at zero beat will be noticed, but this is normal with modulation).



Three size-C cells mounted in battery clips on the inside of the rear panel power the versatile calibrator.

The calibrator is now ready for use. Frequencies of 10+5 kHz and 20+10 kHz can be conveniently used to obtain 15 kHz and 30 kHz channel spacing. Adjustment of the f.m. tranceiver is then accomplished by injecting just enough signal into the 2 meter converter and tweaking the crystal capacitor for zero beat with the signal coming from the calibrator.

If care is taken, sufficient accuracy can be achieved to access most repeators and communicate through them. The output voltage from the calibrator is approximately 2v. P-P. By putting a 100K potentiometer across the output as a voltage divider any desired level up to 2v. P-P can be set for scope calibration purposes. (r.m.s. volts × 2.82 = P-P volts). The calibrator has been very useful in the shack and on the test bench. ■

HUM!

BY J. K. BACH*

IT was a weird-looking little jug, with its Viking-horned helmet and its stout-bottle shape. It was the first a.c. tube and its name was McCullough. No number, just McCullough.

It eliminated static better than all the previous anti-static circuits. It made huge sound outputs possible, and initiated the national trend toward deafness. It accelerated the change in listening habits from DX to network local, and through its high transconductance, outshone both '71-A and 210 in producing low notes. And it conditioned us, in the Pavlov sense, to hum and white noise. Quite an indictment, and quite a tribute to its power. Extreme? Maybe, but hear me out.

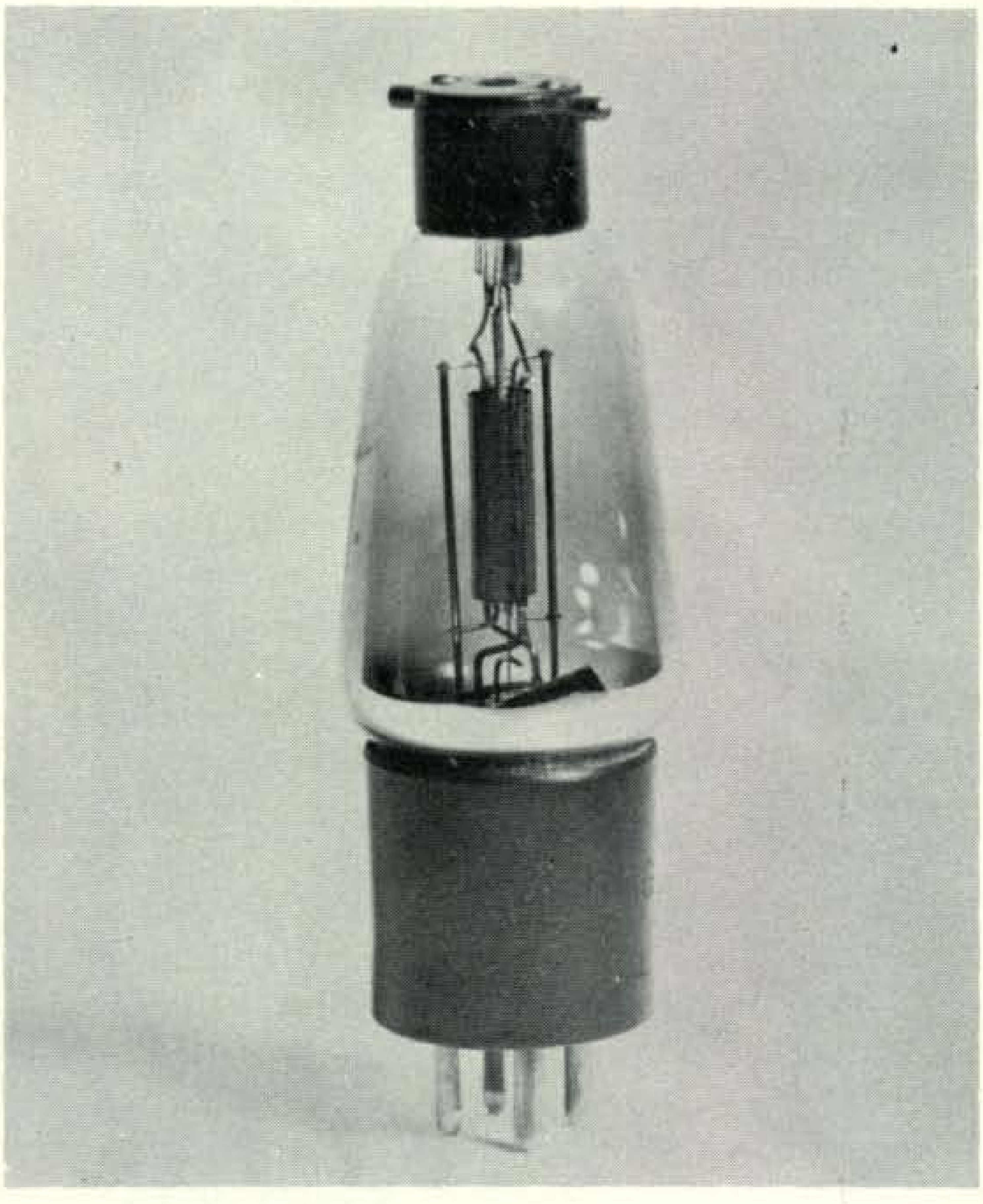
If George Washington had reneged, there would certainly have been some other Father of our Country. But he didn't, and there wasn't. George was first, and he gets the credit. McCullough was also first, and there isn't the slightest doubt about this. And judging by the few traces he left behind, Frederick S. McCullough was one of the great own-business-minders of our time. He is not just obscure, he's almost a myth!

It is pretty definite that he was an ex-Westinghouse tube engineer. He set up the F. S. McCullough Research Laboratories in 1925. He lived in Wilkinsburg, a suburb of Pittsburgh, in 1922-23, listed in the city directory as an engineer. His wife was named Elva, and he may have had a son named Leon. He died before 1937. Period.

But McCullough patented his work as he went along, and we can get a line on his thinking from his patents. Take his #1,549,591, "Method of heat-treating porcelain." No mention of vacuum tubes in it, but we know now what he had in mind: heater insulators for vacuum tubes. He was roasting ceramics in vacuo by means of eddy-currents to purify them. One little speck of Sulfur, for example will go through a ceramic like a termite through a timber, leaving a conductive track behind it. And what that would do to the hum level in a tube! An improvement on this, number 1,607,547 is about insulators containing heater wires. He found that baking the insulators shrunk the holes for the heater wire by a predictable amount. You had to make them about a quarter larger than the final size to make the heater wire fit. Also, that it was better for the wire to have a sliding fit to prevent strains, though there was another patent in which the heater wire was cemented in place.

Still nothing about vacuum tubes in it. But obviously, he was preparing the way for his a.c. tube. One patent, #1,560,183, filed in 1922, has to do with heating a very large cathode-surface with eddy currents from an r.f. oscillator. With that powerful heating supply, it had to be for a transmitter. The plate (and grid?) was segmented to prevent overheating from the eddy currents. He must have been aiming for a.c. operation, even then. He had some other patents, less directly connected with his a.c. concept. One of these was for an alternate method for thoriating filaments.

There is plenty of evidence that he fully realized that there would be a hum problem. Number 1,568,172 in 1926 comes right out and says: "—a cathode which may be heated by alternating or pulsating currents, so that ordi-



McCullough-design tube manufactured by Kellog Switchboard and Supply.

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*Ivy Hill Road, Walden, N.Y. 12586

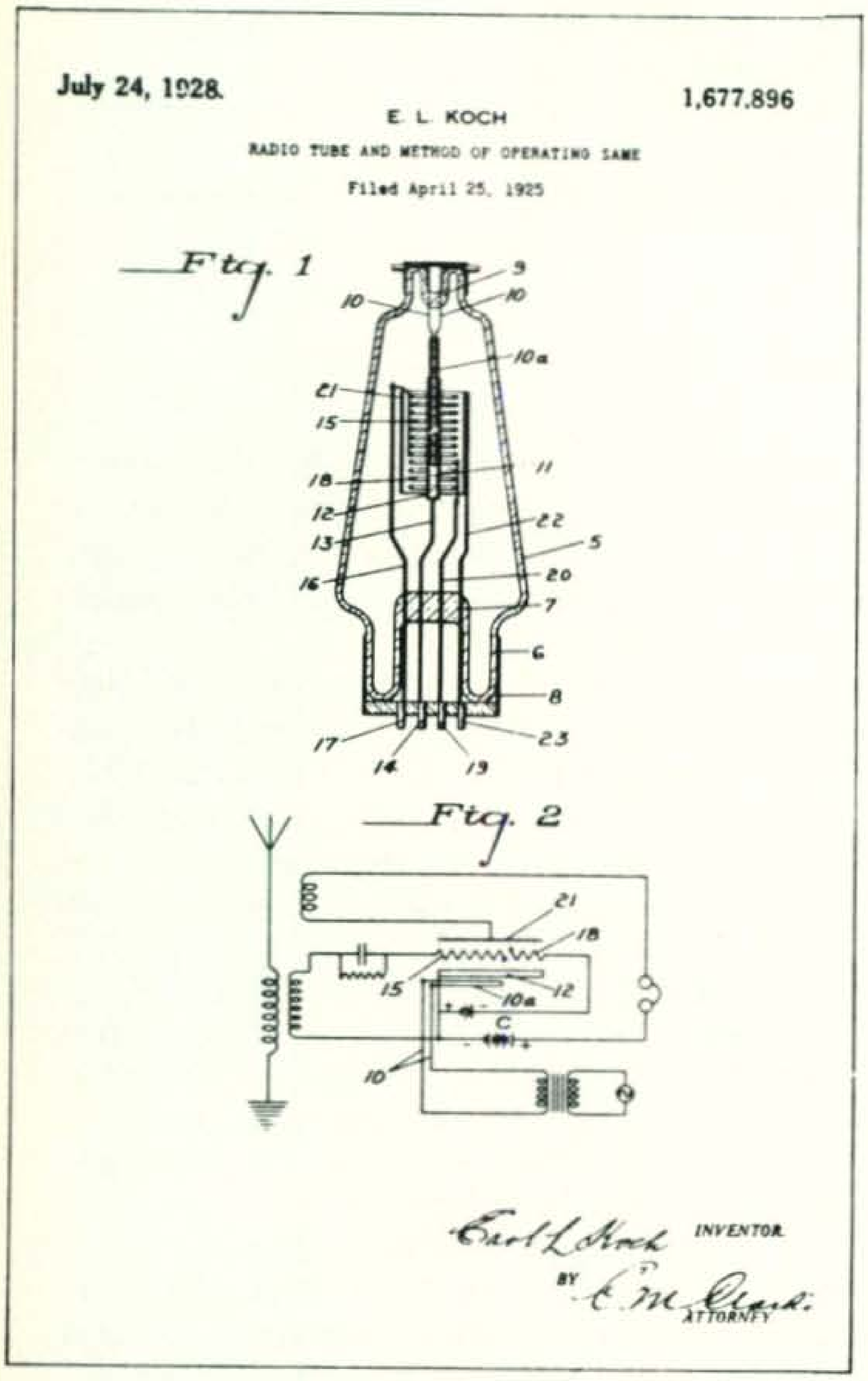

Fig. 1—Patent drawing for a radio tube by Earl Koch was filed in 1925 and assigned to Frederick S. McCullough, with whom he worked for a while. This tube was the first a.c. operated tube to be patented. Note the "auxiliary control electrode 18" which was later abandoned. This second grid whose "effect is not definitely understood" had the undesireable effect of increasing the level of a.c. hum.

nary house-lighting current may be employed in the operation of this tube." He also describes an inner sleeve "—of a magnetic nature, such as nickel or copper." The actual cathode was insulated from this sleeve and outside it. The sleeve was supposed to shield the cathode and prevent hum. Certainly it would greatly lengthen an already substantial warm-up time, and what of the Curie point? At red heat where would the magnetism go? Probably he had in mind the shielding effects of eddy currents. The scheme was never used, but certainly McCullough realized that there would be a hum problem, and he attacked it doggedly.

Curiously, the indirectly-heated cathode concept was known even to the unsophisticated radio experimenters of the day. We called it the "thimble cathode." We weren't quite sure what a cathode was; to us it was a kind of filament, and you had to have it. But the concept was classic; all you needed was heat, and it didn't matter what kind. No filtering, no centertaps, no nothing—just pure, humless operation. Little did we know!

Time was running out, as a tube engineer, McCullough knew the professional gossip. He surely must have known Wade and Freeman of Westinghouse, who filed for a patent on an a.c. tube in 1923. He probably even worked with them when he was at Westinghouse himself. After a lot of backing and filling and revisions, the patent was issued in 1933. The number is 1,909,051 and the main drawing shows the Westinghousest-looking tube you ever saw. One sketch even shows a tetrode version. Knowing what the trends were, McCullough knew he had to market a tube, and soon.

Before 1925, McCullough had become associated with one Earl I. Koch, who was nearly as talented as own-business-minder as McCullough himself. He came from Chicago, and stayed around for a time after leaving McCullough. This fragment is all we know about him.

In his patent, 1,677,896 which he assigned to McCullough, he showed for the first time the shape which the new tube was to take. His drawing shows a double-ended tube, of inverted pear-shape. This made it upside-down as compared to the RCA tubes. McCullough tubes followed this pattern, even to the odd horizontal heater pins on top. Probably the old man understood the value of an unique appearance. (There was at least one imitator, the Sovereign, which was double-ended but used a straight-sided bulb.)

However, the patent had more to it than just a funny-looking bulb. It was concerned with an additional grid element which served to reduce hum. In the patent Koch says: "The theory of the tube, as far as the effect of the auxiliary grid is concerned, is not definitely understood, but tubes employing this feature have successfully demonstrated the practicability of this invention." But the auxiliary grid was abandoned.

Ahem!—may I offer an explanation for the effect of the auxiliary grid? Held negative, it repelled electrons, keeping the plasma from escaping out that end of the element structure. But at the other end, spurts of this electron fog were driven out of the grid endways and attracted to the plate and its support wires. These spurts constituted a substantial 60-Hertz signal and contributed markedly to the hum. The driving field was the near ampere-turn of folded cathode heater. It, the heater, was flattened to provide maximum field cancellation, but this was by no means complete.

Koch also disdained the flowery patent ritual: "To all whom it may concern: be it known—" He starts out: "This invention relates to ther-

[*Continued on page 77*]

The AZ-Special

A no-Compromise 88-foot 80-to-15-meter antenna

BY L. W. AURICK,* K3AZ

A RECENT move to a suburban subdivision found the writer with the usual problem of how to get the most out of limited antenna possibilities; do it with a minimum expenditure of money; obtain some gain where possible; and provide flexibility of use for most of the lower-frequency bands, 80-through 15-meters.

This appeared to be a tall order considering the typical third-of-an-acre we inhabit; with more than its share of trees (none of them properly located with respect to antennas), and a self-imposed restriction of no poles in the front yard.

Towers and triband beams were ruled out since the present condition of the sunspot cycle argued against a large investment at this time for an antenna system that would have only limited use on the higher frequencies. Furthermore, a compromise in the form of an "inverted V" would likely have to be made for both 80-and 40-meters, using the tower as the center support. That is, if the tower could even be located so as to serve this function.

The first solution was a commercial "all-band" vertical, and the addition of thirty-two carefully laid radials lying just beneath the grass. The antenna did "work" on all bands. but the lack of gain, as well as the location of the maximum radiation point (maximum current loop) at ground level left much to be desired. Back to the books.

A compromise began to suggest itself in the form of a 66-foot 40-meter antenna which would also work on 15-meters. Practically everyone used something like this more than twenty years ago when 15-meters first became available. Fed with coax, it would "work" on both 15- and 40-meters, with an acceptable v.s.w.r. Fed with open-wire tuned feeders it would function as a two-section colinear (two-half-waves in phase) on 20-meters. This antenna would offer about 2 db gain on this band. While tuned-feeders of the correct length would permit the antenna to load and function on 75/80-meters, the efficiency of such a short antenna would not offer as much as the typical "inverted V". Then too, there is no gain on 15-meters where the antenna currents in adjacent sections are out of phase.

It began to appear that if the number of elements and phasing sections (to make the elements work in phase and produce gain) would work out to the right dimensions, the colinear could be the answer. With this type of an antenna, particularly if multiband operation is contemplated, one starts out by designing for the highest frequency band and accepts whatever the laws of physics provides

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*561 Oak Ridge Drive, Millersville, PA 17551.

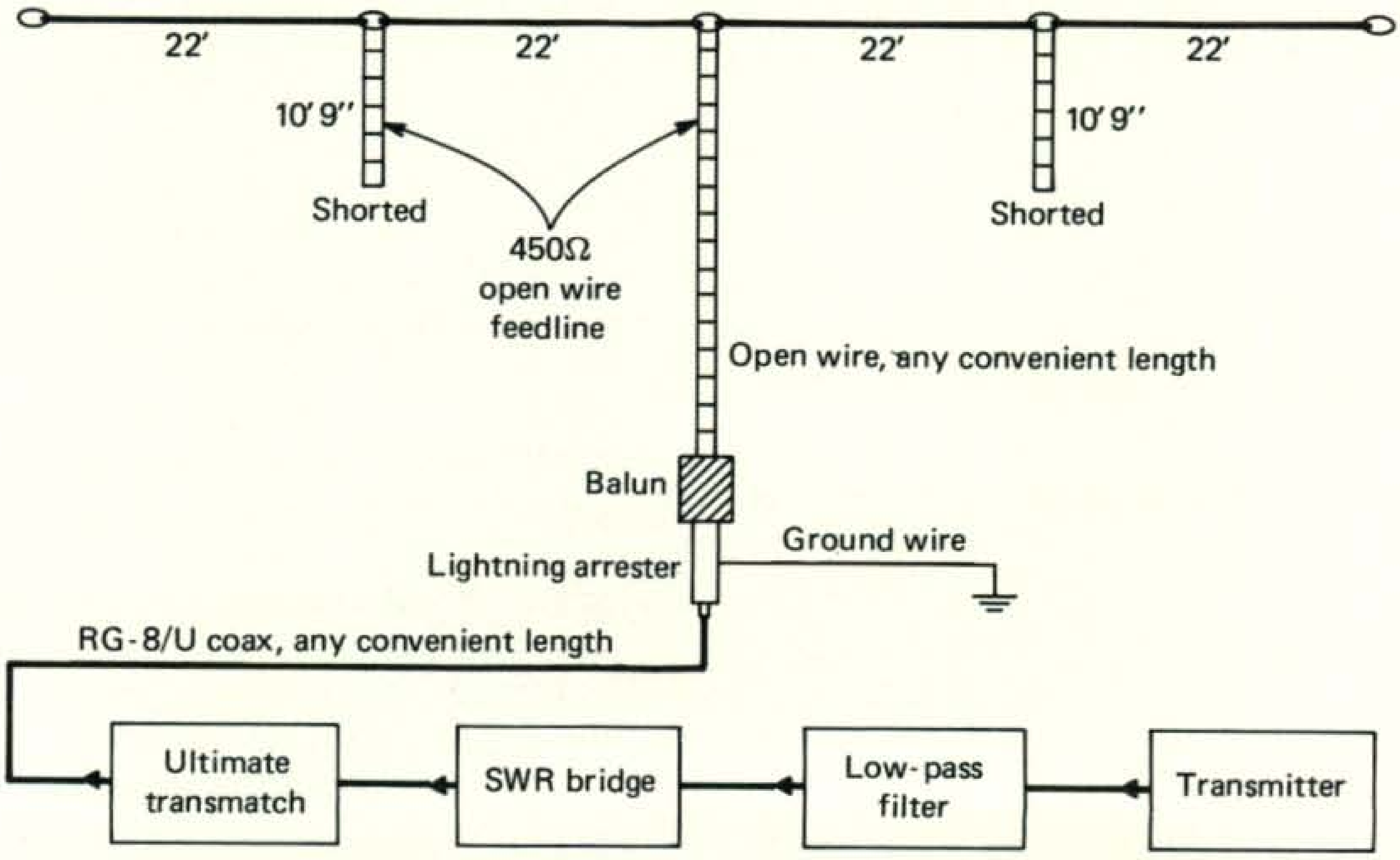

Fig. 1—The AZ-Special 80 through 15 meter no compromise limited space antenna.

for use on the other bands.

Was it possible that there was such a combination of frequency relationship, antenna length, and phasing section length, that an antenna could be put together to serve 80-to 15-meters, and even produce some gain?

Following a review of colinear antenna theory (2-, 3-, and 4-element designs) everything suddenly fit together to solve the particular requirements which had been established. No claim is made by the writer as to the originality of this design. The antenna has probably been around since the days of Hertz and Maxwell. However, except for the two-element version previously discussed, nowhere in the antenna literature has this amateur seen it suggested that an antenna of this type offered real multiband possibilities. As a bonus, there are no heavy and expensive loading coils to heat up, or load up with ice, and there is honest gain to be had on several bands.

The Solution

The antenna about to be described has been up for about 18 months and has given an excellent account of itself on all bands from 80- to 15-meters. Casual descriptions on-the-air have created considerable interest and so many requests for details that it was felt that this antenna should be set down for the benefit of hose with similar requirements. All the more so when one considers that an entire generation of hams now exists with little, if any, antenna knowledge beyond the commercially manufactured triband beam.

The configuration of the antenna is shown in fig. 1. It is a four-section colinear (four-half-waves in phase) on 15-meters. It is characterized by broadside radiation, that is, at right angles to the antenna, and is bi-directional on all bands. The four, 22-foot long, 15-meter half-wave sections contribute approximately 4 db gain. These sections, totaling 88-feet, also determine the overall length of the antenna. Between the inboard and outboard half waves, each side of center, there is a 10-foot 9-inch phasing section. These one-quarter wave phasing sections reverse the phase (current and voltage distribution) in the next (outboard) half-wave section so that the currents in each section are flowing in the same direction (in phase).

20-Meters

On this band, as on all of the others (except 15-meters), the phasing sections function as part of the antenna. They radiate, and contribute to the short length of the antenna. The antenna functions here as four-half-waves (each of them 32-feet, 9-inches long, which includes half of a phasing section), but not in phase. The two wavelengths (one each side of center) cause the lobes of maximum radiation to appear at approximately 45-degree angles to the antenna. At K3AZ the antenna is broadside NE and SW, and it seems to work well, on this band, in the anticipated directions of North, East, South and West. Central and South American, as well as African, European, US West Coast, Hawaiian, and Australian stations have reported favorably on the antenna, particularly when one considers the current state of the solar cycle, and the resultant generally poor band conditions.

40-Meters

Here, the antenna, electrically 65-feet, 6-inches long each side of center (including the phasing sections), performs as two-half-waves in phase. Such a two-section colinear configuration theoretically provides approximately 2 db gain. On-the-air reports from domestic as well as DX stations indicate that this is the best 40-meter antenna this operator has ever used.

75-80 Meters

On this band the antenna (electrically 131 feet long) functions as an ordinary half wave dipole. All the electrical length is there, and there are no lossy coils responsible for its modest 88-foot expanse. Reports from throughout the U.S. and Canada as well as from European s.s.b. stations, average S9. This, with a modest 500-watts input.

Feeding the Array

The antenna is fed with 450-ohm open-wire line of the type commonly used today in TV installations. This line is readily available from Lafayette Radio and is stocked under their numbers 32 E 36130 in 100-foot coils; 32 E 36148 in 250-foot coils; and 32 E 36155 in 500-foot coils. The phasing sections are made of the same type of line and are permitted to dangle straight down. The line is "light," and it takes a rather strong breeze to move it.

One thing that the user of this antenna will have to accept as a fact of life is the substantial waves that will be present on the feedline. However, as W2DU and others have been telling us for some time, this does not cause a loss of power to the antenna when low-loss feedline is used. And this open-wire line is as low-loss as anything you are ever likey to see. The only loss is in the normal resistance of the wire itself, which is negligible, and you are never going to find a way to overcome this, anyway.

Make the feedline any convenient length to reach the shack, or a point outside, where you can convert from the balanced line to an unbalanced line by means of a balun. At K3AZ the feeders drop approximately fifty-five feet to the roof of a porch where they are connected to a W2AU ferrite balun. The balun is connected to a coax lightning arrester and a heavy wire is run from there to an 8-foot copper ground rod. RG-8/U coax runs from the other side of the coax-lightning arrester for approximately 35-feet, down the side of the porch, through the foundation to the basement, and up through the shack floor, behind the operating desk. Here the coax is terminated in an Ultimate Transmatch. The transceiver always looks at 50 ohms, and the v.s.w.r. between the Transmatch and the antenna is just ignored.

There are virtually no losses in the 450-ohm open-wire line, and the losses in the short length of RG-8/U coax are too small to even consider. As countless other amateurs still do, the writer, a purist at heart, was once committed to flat, or tuned lines. OK. Have your flat line and unity v.s.w.r. if you are using a long run of coax, but forget about it if you are using open-wire line, and want to take advantage of a real multiband antenna.

Summary

The use of the Ultimate Transmatch is the key to the practicality of this antenna. The writer would never be without one again. The balun is necessary for the obvious need to convert from the balanced to unbalanced feed, and the one used here does a fine job.

The antenna is supported between a 50-foot telescoping TV mast and a 50-foot "A" frame. It is truly a no-compromise 80- to 15-meter antenna. Just one limitation. The antenna must be mounted entirely horizontal. If the antenna is hung in an "inverted V" configuration there will be no gain on 40- and 15 meters.

If you don't have room for the 88-foot flattop, don't let that stop you either. At K3AZ there was only about 75-feet between the masts. Nine feet at each end were permitted to hang down. These ends were secured with an insulator and a light piece of nylon cord to keep them from flapping in the breeze.

This antenna has worked so well on each band, and at so little cost or effort, it will likely continue to be used even if more space becomes available at some future date.

Hope you'll give the AZ Special a try. If you do, please let me hear from you. ■

The Plumbers Delight

BY SAM GUCCIONE,* W3GVP

HAVE you ever wondered why the standard coaxial line impedance is 50 ohms? I have many times. Some years ago, I stumbled upon an excellent explanation of why 50 ohms is the standard. It goes something like this.

In a low loss coaxial transmission line, the only important dimensions are the inside diameter (i.d.) of the outer conductor, *D*, and the outside diameter (o.d.) of the inner conductor, *d*. Two characteristics of transmission lines which depend upon the ratio D/d are the characteristic impedance (Z_o) and the attenuation due to losses in the metallic conductors. The characteristic impedance is given by the familiar formula:

$$Z_o = \frac{138}{\sqrt{\epsilon_r}} \log_e D/d$$

where ϵ_r is the relative dielectric constant of the dielectric material between the inner and outer conductors. A normalized plot of the attenuation[1] is shown in fig. 1. The minimum attenuation occurs for a Z_o of 77 ohms.

Two other important transmission line characteristics which are functions of D/d (that is, Z_o) are the breakdown voltage and the power carrying capacity. The breakdown voltage as a function of Z_o is shown in fig. 1. The highest breakdown voltage occurs at a Z_o of 60 ohms.

[*Continued on page 75*]

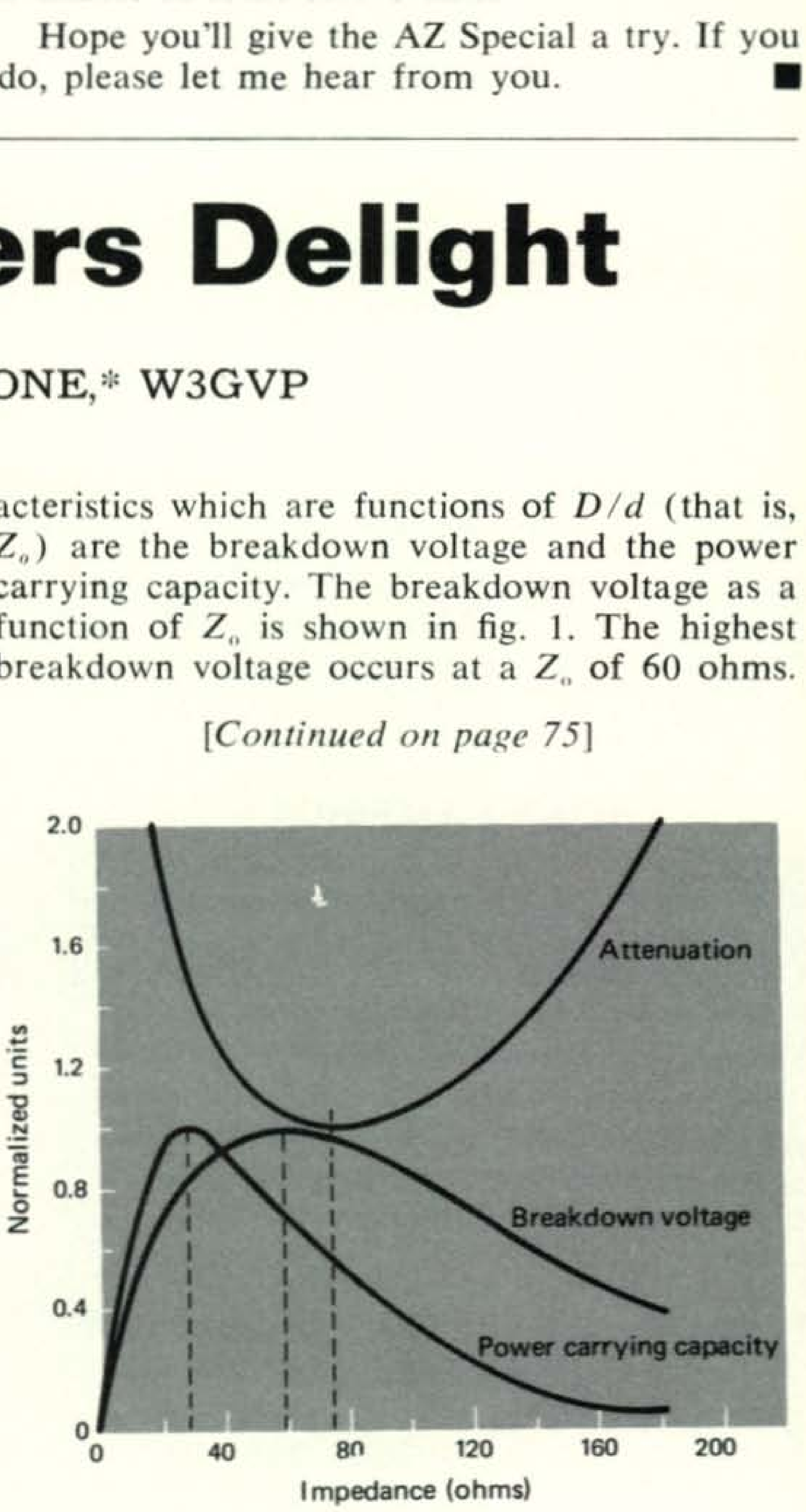

Fig. 1—Transmission line properties versus Impedance.

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*110 Chalet Court, Camden, DE 19934.

[1] T. Moreno, *Microwave Transmission Design Data,* Dover Publications, New York, pp. 63-65.

CQ World-Wide DX Contest
ALL-TIME PHONE RECORDS

BY FRED CAPOSSELA, JR., K6SSS

In the records listed below, boldface listings denote world records. Number groups after calls are: year of operation, total score, contacts,

Single Operator/Single Band
WORLD RECORD HOLDERS

1.8	**KV4FZ ('72)**	**8,050**	**168**	**8**	**15**
3.5	**VE3MR/4X ('71)**	**197,106**	**742**	**22**	**69**
7.0	**HR1RF ('72)**	**399,542**	**1349**	**28**	**93**
14	**CV4C ('73)**	**1,233,128**	**2518**	**37**	**130**
21	**CW4CR ('70)**	**1,196,085**	**2462**	**39**	**126**
28	**KG6SL ('72)**	**933,577**	**2467**	**33**	**94**

AFRICA

1.8	No Entrant				
3.5	CN8HD ('72)	55,366	303	13	49
7.0	EA8CR ('74)	253,528	639	31	103
14	CR6WW ('74)	1,058,446	2152	35	132
21	CR6NO ('73)	658,668	1706	34	97
28	CR6CN ('72)	650,160	1737	31	95

ASIA

1.8	4X4UR ('74)	1,188	35	3	9
3.5	**VE3MR/4X ('71)**	**197,106**	**742**	**22**	**69**
7.0	VE3MR/4X ('72)	215,840	643	27	88
14	4W1GM ('74)	705,602	1566	34	123
21	JA1RJW ('69)	379,136	1197	37	91
28	4X4JU ('69)	570,836	1522	34	99

EUROPE

1.8	PA0HIP ('74)	5,200	249	4	16
3.5	LA0AD ('70)	80,754	757	20	66
7.0	EA4LH ('74)	164,952	678	25	91
14	G5AAM ('67)	824,344	1634	39	144
21	G3HCT ('69)	832,016	2124	37	112
28	DL4PM ('68)	614,544	1858	34	84

NORTH AMERICA

1.8	**KV4FZ ('72)**	**8,050**	**168**	**8**	**15**
3.5	KV4FZ ('73)	183,200	836	20	80
7.0	**HR1RF ('72)**	**399,542**	**1349**	**28**	**93**
14	KV4FZ ('71)	1,208,180	2680	40	153
21	VE3MR ('69)	550,212	1292	39	117
28	KP4AST ('70)	630,180	2010	31	104

OCEANIA

1.8	KH6CHC ('73)	272	12	5	3
3.5	KH6EPW ('66)	5,040	82	10	11
7.0	VK6CT ('73)	135,810	521	29	61
14	VK6HD ('72)	706,251	1483	37	132
21	KG6AQY ('70)	749,529	2353	32	72
28	**KG6SL ('72)**	**933,577**	**2467**	**33**	**94**

SOUTH AMERICA

1.8	CX3BH ('73)	18	4	2	4
3.5	YV4AGP ('72)	72,666	388	18	48
7.0	4M1BI ('72)	155,664	604	26	69
14	**CV4C ('73)**	**1,233,128**	**2518**	**37**	**130**
21	**CW4CR ('70)**	**1,196,085**	**2462**	**39**	**126**
28	YV1LA ('68)	664,560	1898	33	87

Single Operator/All Band

AF	**ZD3X ('74)**	**6,653,881**	**4611**	**115**	**372**
AS	XU1DX ('74)	2,607,750	2711	133	342
EU	EA4LH ('72)	2,744,119	2399	125	344
NA	KV4FZ ('70)	4,961,551	4362	128	369
O	KH6RS ('72) (Opr. K2SIL)	5,331,072	4739	128	256
SA	4M6AW ('74)	6,428,946	4741	112	394

WORLD RECORD

Station	Band	Contacts	Zones	Countries
ZD3X	1.8	10	5	5
Opr.	3.5	225	12	34
OH2BH	7.0	288	19	57
(1974)	14	1184	27	96
6,653,881	21	1771	26	89
	28	1133	26	91
	Total	4611	115	394

Multi-Operator/Single Xmtr

AF	IH9AA ('73)	3,719,573	3229	102	305
AS	OD5HC ('74)	4,606,547	3375	109	364
EU	UK3AAO ('72)	3,883,008	2939	137	375
NA	VP2MSU ('74)	5,512,584	5339	112	350
O	KG6SW ('73)	2,662,968	2928	113	195
SA	**PY2CAB ('74)**	**6,959,474**	**4495**	**130**	**397**

WORLD RECORD

Station	Band	Contacts	Zones	Countries
	1.8	—	—	—
PY2CAB	3.5	13	5	7
(1974)	7.0	48	18	23
6,959,474	14	1535	39	154
	21	1993	36	127
	28	906	32	86
	Total	4495	130	397

Multi-Operator/Multi-Xmtr

AF	ZD3X ('72)	14,501,872	8571	141	455
AS	4Z4HF ('71)	6,106,290	3994	125	409
EU	OH5SM ('69)	11,593,925	6771	153	526
NA	PJ0MM ('68)	7,037,658	6406	134	343
O	KS6DH ('72)	5,488,856	5304	116	242
SA	**PJ9JR ('74)**	**19,469,094**	**10043**	**142**	**519**

WORLD RECORD

Station	Band	Contacts	Zones	Countries
	1.8	36	7	15
PJ9JR	3.5	663	18	63
(1974)	7.0	1104	26	102
19,469,094	14	3804	35	157
	21	2032	31	109
	28	2404	25	73
	Total	10043	142	519

Club Record: Potomac Valley Radio Club ('74) 53,869,662

CQ World-Wide DX Contest
ALL-TIME C.W. RECORDS

DIRECTOR, CQ W.W. DX CONTEST

zones, and countries. All-band and Multi-Operator records include a band-by-band breakdown of the world leader in each category.

Single Operator/Single Band
WORLD RECORD HOLDERS

1.8	**KV4FZ ('73)**	**21,320**	**220**	**11**	**29**
3.5	**YU3DBC ('74)**	**135,408**	**853**	**22**	**69**
7.0	**KP4AST ('73)** **(Opr. WA4PXP)**	**447,421**	**1479**	**32**	**95**
14	**CR6IK ('74)**	**925,386**	**2021**	**38**	**116**
21	**CW9BT ('72)**	**696,133**	**2068**	**31**	**82**
28	**CX1AAC ('70)**	**681,636**	**1711**	**36**	**93**

AFRICA

1.8	No Entrant				
3.5	CN8DW ('70)	15,759	153	9	26
7.0	5A1TW ('64)	227,814	918	22	64
14	**CR6IK ('74)**	**925,386**	**2021**	**38**	**116**
21	TJ1AW ('70)	549,888	1447	35	93
28	CR6IK ('69)	498,800	1439	36	80

ASIA

1.8	4X4NJ ('74)	4,818	76	6	16
3.5	UI8LAG ('74)	92,300	555	16	49
7.0	4X4FA ('64)	174,505	781	25	60
14	HL9KH ('63)	339,920	910	37	103
21	KA6AY ('72)	284,688	920	30	78
28	HZ1AB ('68)	132,390	578	21	55

EUROPE

1.8	PA0HIP ('74)	12,704	328	9	23
3.5	**YU3DBC ('74)**	**135,408**	**853**	**22**	**69**
7.0	LA0AD ('71)	177,450	851	31	74
14	SM4CMG ('71)	367,356	1172	38	100
21	G3HCT ('70)	317,312	924	38	96
28	DL4AAP ('57)	253,680	728	36	84

NORTH AMERICA

1.8	**KV4FZ ('73)**	**21,320**	**220**	**11**	**29**
3.5	W1MX ('72)	80,410	329	22	64
7.0	**KP4AST ('73)** **(Opr. WA4PXP)**	**447,421**	**1479**	**32**	**95**
14	KV4FZ ('70)	908,514	2315	36	117
21	WA8LYF ('70) (Opr. K8HLR)	286,767	756	35	94
28	K1JGD ('68)	158,510	520	28	82

OCEANIA

1.8	KH6CHC ('73)	2,845	62	8	7
3.5	KH6HCM ('70)	11,286	200	10	6
7.0	ZL1AMO ('74)	174,867	770	25	52
14	VK3APJ ('67)	422,240	1150	35	95
21	VK6HD ('71)	531,354	1576	32	82
28	VK8UG ('67)	320,008	1048	32	72

SOUTH AMERICA

1.8	9Z4GS ('73)	5,252	70	10	16
3.5	YV5AW ('73)	74,144	445	17	39
7.0	CV7B ('73)	196,480	834	25	55
14	PY4AP ('71)	836,250	1874	37	113
21	**CW9BT ('72)**	**696,133**	**2068**	**31**	**82**
28	**CX1AAC ('70)**	**681,636**	**1711**	**36**	**93**

Single Operator/All Band

AF	**ZD3X ('73)** **(Opr. OH2BH)**	**3,524,826**	**3404**	**96**	**251**
AS	UK9ABA ('70)	1,719,663	1366	124	327
EU	OH5SE ('69)	1,419,186	1374	124	298
NA	KV4FZ ('69)	2,719,152	2867	127	287
O	KH6RS ('72) (Opr. W6MAR)	2,748,307	2990	121	190
SA	9Y4AA ('69)	3,088,968	2623	123	279

WORLD RECORD

Station	Band	Contacts	Zones	Countries
ZD3X Opr. OH2BH (1973) 3,524,826	1.8	—	—	—
	3.5	176	13	32
	7.0	391	20	44
	14	1057	24	70
	21	1170	21	60
	28	610	18	45
	Total	3404	96	251

Multi-Operator/Single Xmtr

AF	CT3WA ('74)	3,003,196	2698	100	279
AS	**OD5IQ ('74)**	**3,970,912**	**2966**	**120**	**344**
EU	UK5IAZ ('72)	2,112,240	1885	140	380
NA	KP4EAJ ('74)	2,683,525	3343	109	250
O	FW0AA ('74)	1,149,644	2082	80	114
SA	FY7AA ('74)	3,750,121	3208	120	289

WORLD RECORD

Station	Band	Contacts	Zones	Countries
OD5IQ (1974) 3,970,912	1.8	33	7	14
	3.5	326	12	50
	7.0	660	24	71
	14	777	31	86
	21	793	28	72
	28	377	18	51
	Total	2966	120	344

Multi-Operator/Multi-Xmtr

AF	ET3FMA ('67)	1,387,680	1476	105	231
AS	VU2IRA ('70)	2,273,616	2128	125	307
EU	OH2AM ('68)	4,118,688	3277	155	412
NA	W4BVV ('70)	5,552,352	3056	158	456
O	KS6ER ('73)	1,415,650	2136	102	123
SA	**PJ0FC ('70)**	**11,586,428**	**7090**	**150**	**401**

WORLD RECORD

Station	Band	Contacts	Zones	Countries
PJ0FC (1970) 11,586,428	1.8	92	8	8
	3.5	668	17	46
	7.0	1338	26	75
	14	1974	34	109
	21	1641	34	84
	28	1377	31	79
	Total	7090	150	401

CQ World-Wide DX Contest
ALL-TIME U.S.A. RECORDS

Tabulated below are the record-high scores achieved by U.S. contesters in the *CQ* World Wide DX Contest. All-Time World-High scores are shown on pages **38** and **39**. Number groups following calls and bands are: year of operation, total score, contacts, zones, and countries.

PHONE

Single Operator/Single Band

1.8	WB8APH ('74)	2,175	91	9	20
3.5	W1EBC ('74)	44,540	225	20	65
7.0	W3PHL ('72)	99,912	316	31	88
14	W4AXE ('70) (Opr. WA4PXP)	595,725	1068	39	156
21	W2AH ('72)	485,605	1129	34	111
28	W2SKE ('68)	429,976	1030	34	108

Single Operator/All Band

Station	Band	QSOS	Zones	Countries
	1.8	—	—	—
	3.5	50	18	28
W6RR	7.0	164	22	33
(1972)	14	297	32	87
2,350,964	21	949	31	86
	28	360	31	81
	Total	1820	134	315

Multi-Operator/Single Xmtr

Station	Band	Contacts	Zones	Countries
	1.8	—	—	—
	3.5	192	20	66
W3WJD	7.0	84	24	58
(1974)	14	794	36	132
2,440,167	21	414	29	109
	28	85	18	55
	Total	1569	127	420

Multi-Operator/Multi-Xmtr

Station	Band	QSOS	Zones	Countries
	1.8	4	3	3
	3.5	127	19	46
WA2ZAA	7.0	228	29	78
(1969)	14	936	39	138
6,743,880	21	1183	38	126
	28	1012	33	103
	Total	3490	161	494

CW

Single Operator/Single Band

1.8	K1PBW ('74)	9,750	94	14	25
3.5	W1MX ('72) (Opr. WA1CQW)	80,410	329	22	64
7.0	K6EBB ('72)	228,786	774	31	71
14	W4AXE ('68) (Opr. WA4PXP)	396,414	836	39	123
21	WA8LYF ('70) (Opr. K8HLR)	286,767	756	35	94
28	K1JGD ('68)	158,510	520	28	82

Single Operator/All Band

Station	Band	QSOS	Zones	Countries
	1.8	—	—	—
	3.5	138	20	46
W3WJD	7.0	215	28	70
(1972)	14	295	36	88
1,527,500	21	323	30	81
	28	150	20	51
	Total	1121	134	336

Multi-Operator/Single Xmtr

Station	Band	QSOS	Zones	Countries
	1.8	13	6	9
	3.5	110	20	47
K1DIR	7.0	419	27	79
(1972)	14	334	33	84
1,985,310	21	319	27	75
	28	206	20	59
	Total	1401	133	353

Multi-Operator/Multi-Xmtr

Station	Band	QSOS	Zones	Countries
	1.8	14	4	5
	3.5	173	25	56
W4BVV	7.0	665	33	86
(1970)	14	810	38	122
5,552,352	21	909	37	107
	28	485	31	80
	Total	3056	168	456

Club Record: Potomac Valley Radio Club ('74) 53,869,662

antennas

BY WILLIAM I. ORR, *W6SAI

"You look as if you had lost your best friend," I remarked as Pendergast slowly walked in the door of the shack and settled into his favorite chair with a deep sigh.

"I aged 20 years in 20 minutes yesterday," he replied in a tired voice. "I never worked the *Mount Athos* gang. And boy! I really got shot out of the saddle by Don, K5DUT. That was a real lesson in humility."

"Well, do you know what Don's using for an antenna? They do *big* things down in Texas."

"No," replied Pendergast. "What's he got? A stacked, rotary rhombic?"

I reached into the drawer of the operating desk and pulled out a QSL card and photograph. "Here it is," I replied (fig. 1). "Don has a 6 element, tri-band Quad on a 50 foot boom. It is 80 feet in the air. And he runs an *Alpha-70* amplifier into it. No wonder he rubbed your nose in the dust."

"I suggest we talk about something else," said Pendergast as he gazed at the photograph. "Anything of interest from your readers, to change the subject?"

I pointed to a letter on the desk. "There's a lot of good work going on in regard to low-band DX antennas now that the sunspot cycle is approaching a minimum. Look at the simple 80 meter antenna that WA6WUI is using (fig. 2). This is a sloping V-antenna and Howard ties the top of it onto his tower and has done right well for 80 meter DX. Each leg of the antenna is 63′2″ long and the feed point, or apex, is only 47 feet high. The feedline is 50 ohm coaxial line (RG-58A/U). The antenna is cut for 3.8 MHz and the feedpoint impedance was made to match the line impedance by adjusting the spacing between the ends of the legs. Howard moved one leg back and forth until he got an s.w.r. reading of 1.1 at 3800 kHz. The measured s.w.r. was below 2 between 3700 kHz and 3900 kHz. He finally ended up with a spacing of 63′2″ between the ends, which were about 4 feet clear of the ground.

"The ends of the antenna are hot, don't forget that, so you have to make sure that the neighborhood kids don't touch the wires when the rig is on the air. It might be a good idea to raise the ends so they can't be touched from the ground."

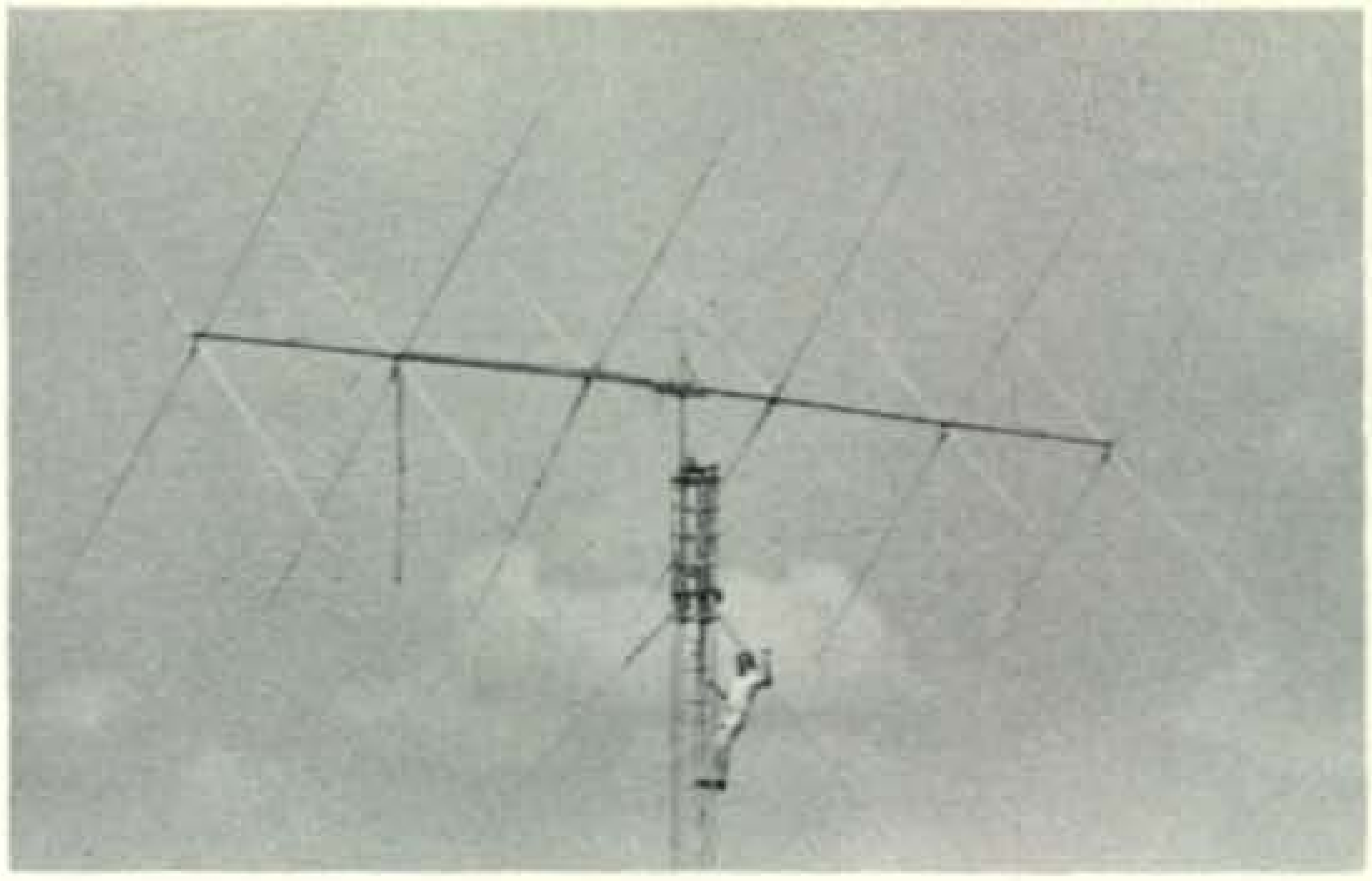

Fig. 1—The "big gun" at K5DUT. A six element Quad for 20, 15 and 10 meters on a 50 foot boom. The antenna is supported 80 feet in the air on a Rohn type 55 tower. Warning! Stay clear of Don in a pile-up.

Pendergast was scribbling in his notebook, which he produced as if by magic from a pocket of his jacket. "How well does it work?" he asked.

"Howard says he's worked some interesting DX on SSB, such as VR1AA, 6W8DY, UP2A and VS6DO."

"Enough!" said my friend, holding up his hand in mock protest. "Anybody that can work that on 80 meter s.s.b. certainly has an antenna that works, no matter how simple it looks!"

"Well, I understand there's an even more simple 80 meter DX antenna called a *sloper,*" I replied. "I've never seen one, but I got a description of one from W6MZ. All it is is a quarter-wave wire, top fed and hung from a metal tower, like this." I drew fig. 3.

"That doesn't look right," objected Pendergast. "Where's the rest of the antenna?"

"That's all of it," I replied. "The shield of the coaxial line is grounded to the tower at the

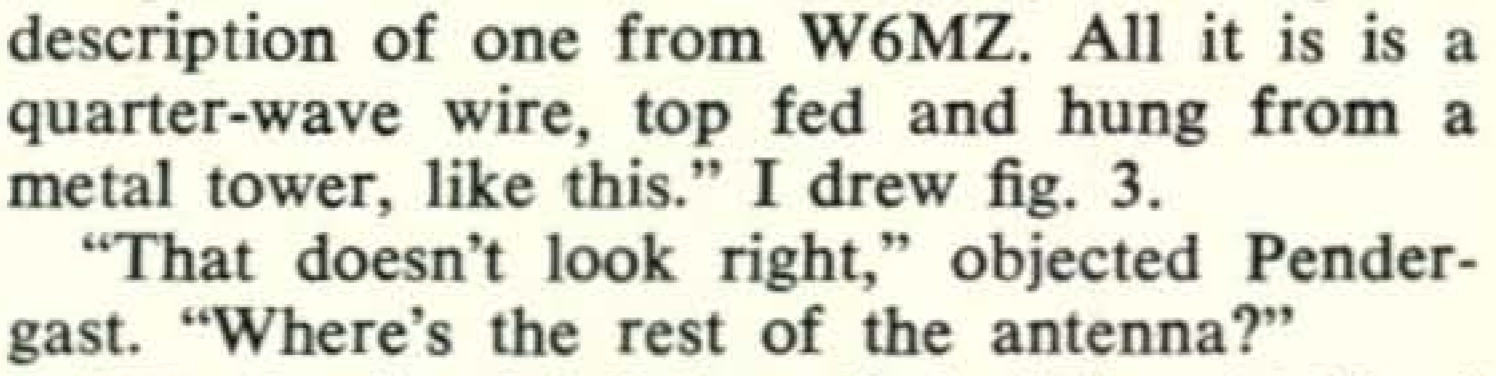

Fig. 2—The sloping 80 meter V-antenna at WA6WUI. The bisector of the angle of the antenna is in a NW-SE direction. Antenna is fed at the apex with 50 ohm coaxial line. Howard reports plenty of DX with this simple antenna.

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*48 Campbell Lane, Menlo Park, CA 94025.

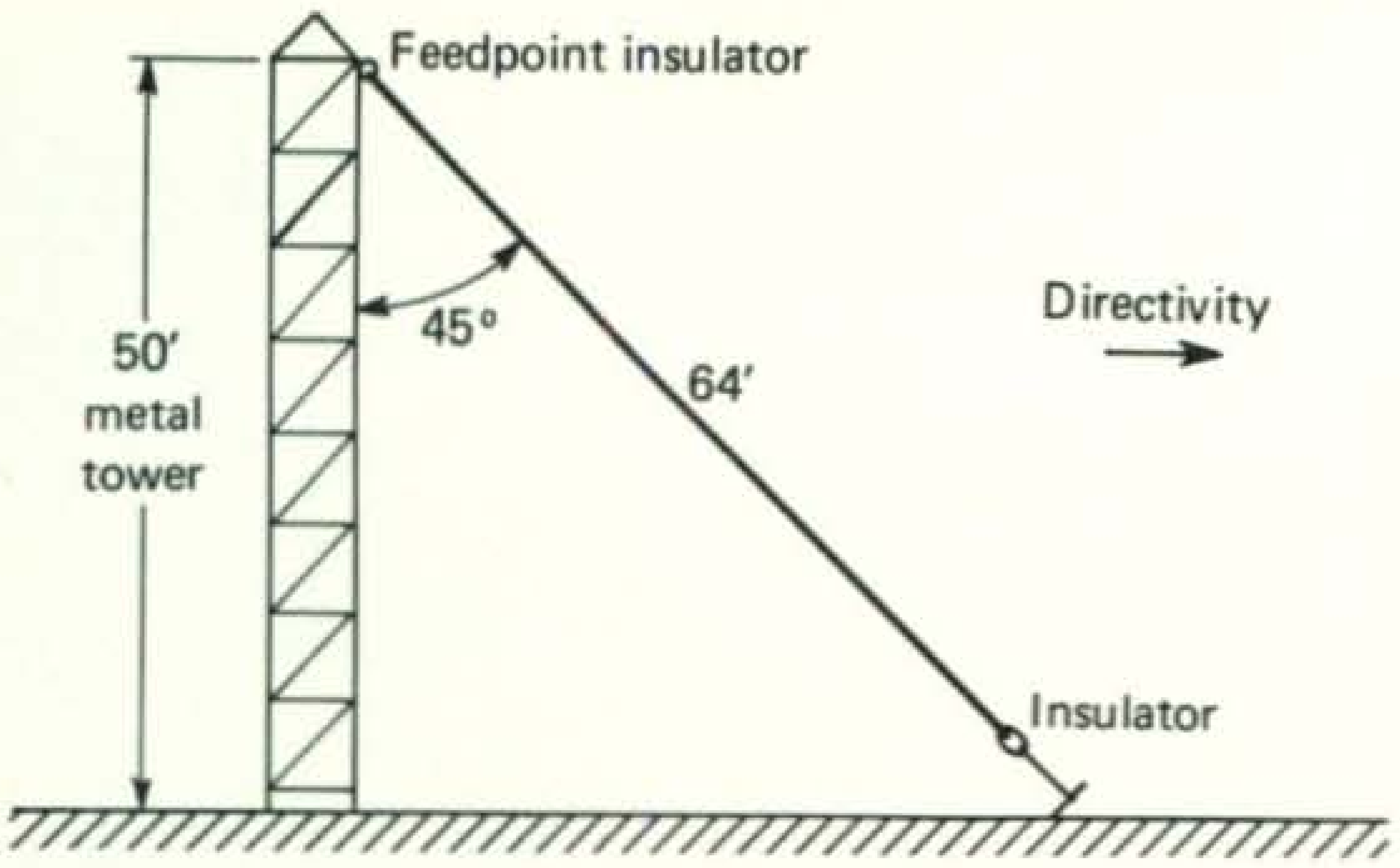

Fig. 3—The 80 meter "sloper" at W6MZ consists of a single wire, fed at the top with a 50 ohm coaxial line. The center conductor of the coax is attached to the wire and the braid is grounded to the tower. Jack suggests that if the tower is a sectionalized, crank-up affair, that it be shunted with a length of copper wire, as the electrical conductivity between sections is poor. When the wind blows, the SWR shifts slightly. The bottom of the tower is grounded by multiple rods driven into the soil.

top and the inner conductor is hooked to the antenna wire! I guess the tower acts as a sort of lop-sided ground plane. Who knows? But fellows seem to be using it. I would sure like to hear from somebody who has actual working knowledge of this screwey device. And look at the s.w.r. curve that Jack plotted for his sloper (fig. 4). That certainly is a broadband response. Beats me how it works, but it does."

"What else do you have up your kilties?" asked Pendergast.

"Here's another good one," I replied. "My old friend Carl, W0BWJ, works portable on occasion from an apartment in the San Francisco area. He's an airline pilot, you know, and always on the move. He's got an FT-101 transceiver in a carrying case and operates from all sorts of odd places with makeshift antennas. Well, he can't put up an antenna in the apartment, because of landlord objections. So Carl examined the building closely and found that it had a double roof for ventilation purposes and that a screened ventilator slot ran all around the building, just under the eaves. The slot was to let warm air out of the attic space between the ceiling and roof of the building. The perimeter of the building was about 400 feet, and this slot ran all the way around it.

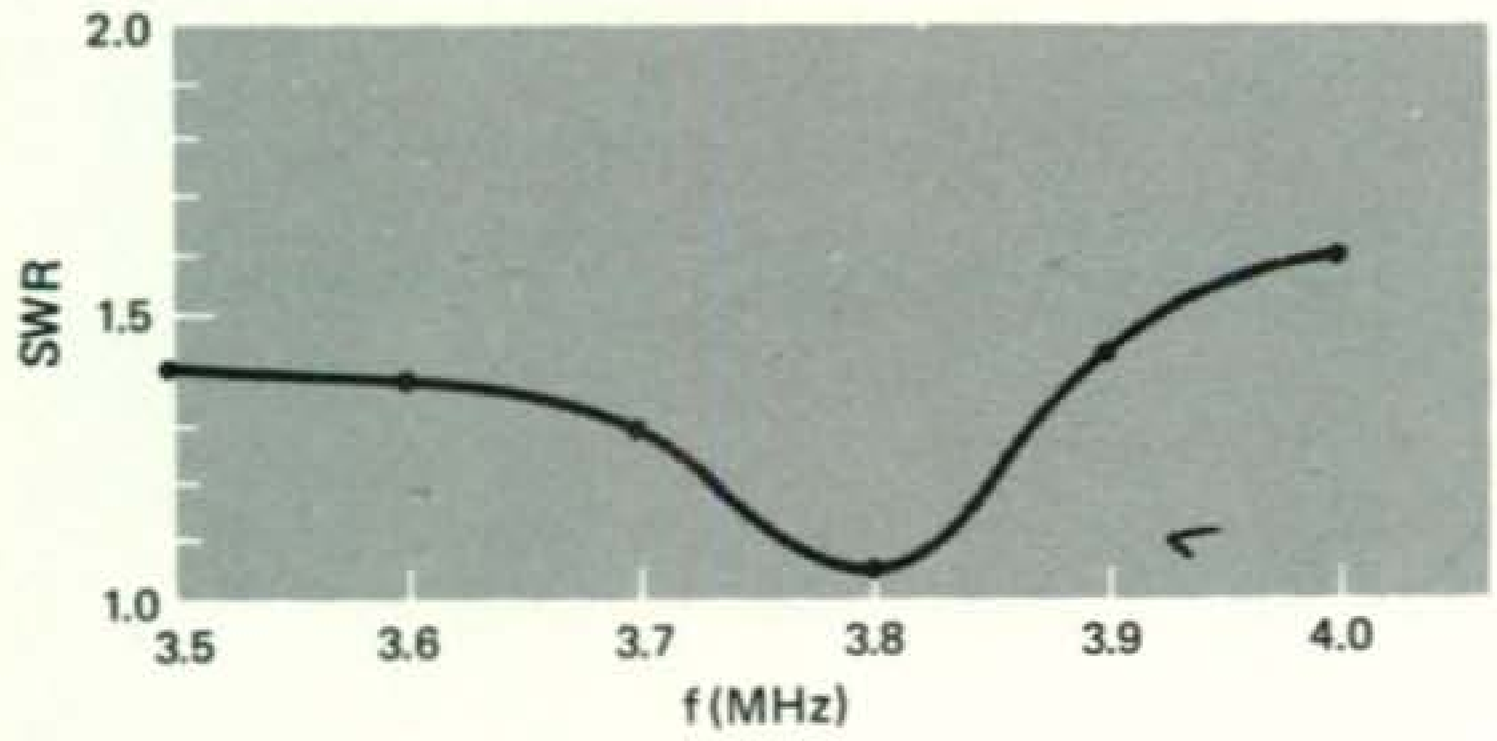

Fig. 4—The s.w.r. plot of W6MZ's 80 meter "sloper" antenna cut for 3.8 MHz. Looks too good to be true, doesn't it? The author of this column would appreciate reports from other amateurs using this remarkably simple antenna. How does it work for you?

"Upon closer examination, Carl found the screening was laid down in sections, about a foot wide and 20 feet long. The section overlapped on the ends and they were held together with heavy double-pronged roofing nails.

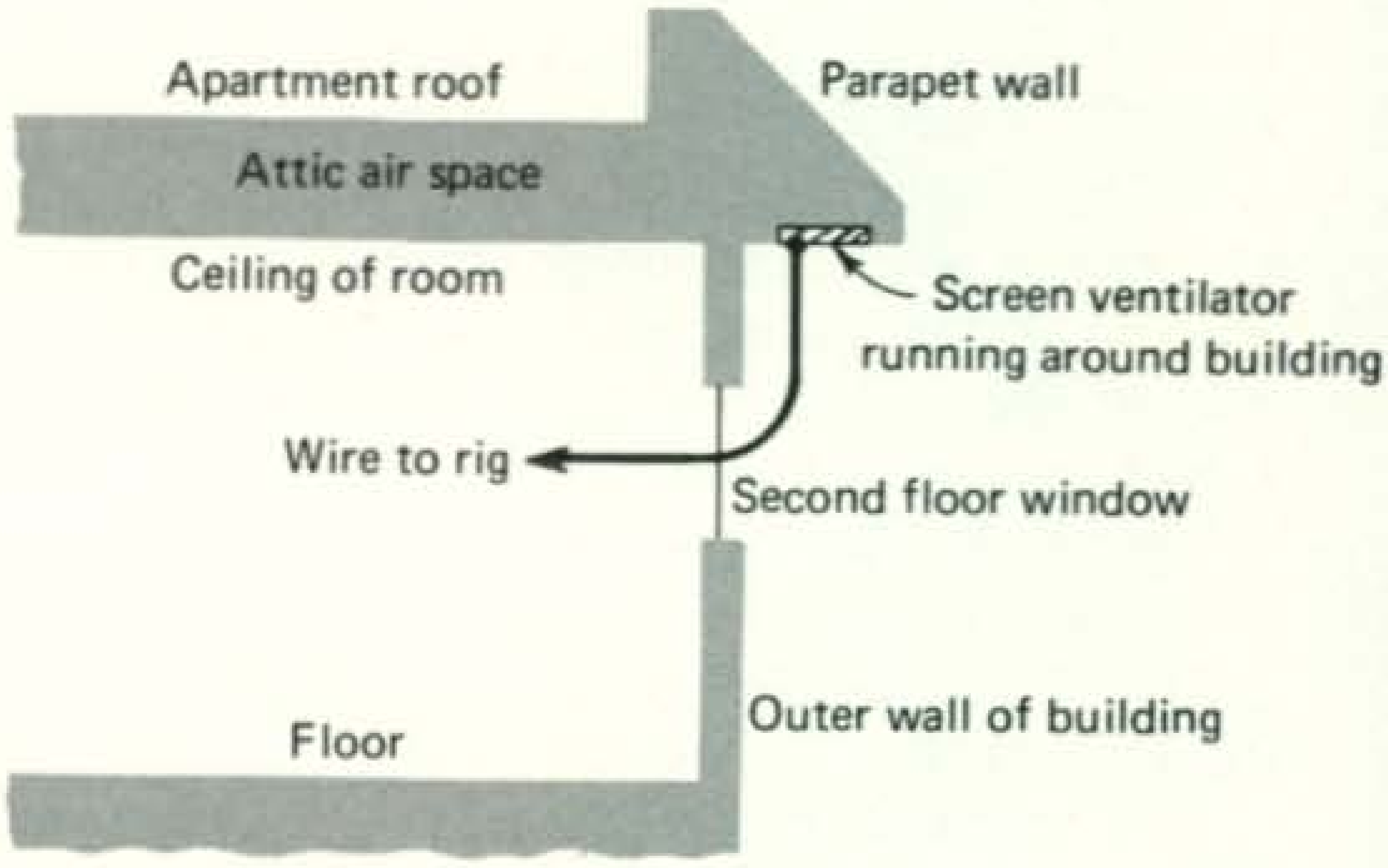

Fig. 5—The "invisible" antenna of W0BWJ/6. Carl uses the screened ventilating slot that runs around the base of the parapet wall of his apartment building as an end-fed antenna. He clips onto the screen and works it against a common ground composed of the water piping of the building plus individual ground radial wires. Perimeter of the building is about 400 feet, so there's plenty of radiating metal in the air.

"So he decided to make this screening his antenna! Look at fig. 5. He ran a short, insulated wire out the second story window with an alligator clip on the end. By merely reaching up, he clipped the screen just above his window. He used a utility antenna tuner such as in fig. 6. For a ground connection, he used the water system of the apartment, together with several quarter-wavelength ground radials, one of each band. The radials were made out of insulated hookup wire and ran across the floor, near the walls of the apartment. The 80 meter radial was 66 feet long, the 40 meter radial 33 feet long and the 20 meter radial 16 feet long. For 160 meters, he omitted the radial and just used the copper plumbing system.

"Carl reports that the makeshift antenna system works very well and he's maintained schedules with home and worked a lot of stations with the 'invisible' antenna. This just shows that you can't keep a good amateur off the air."

Pendergast said, "Too bad Carl can't get up on that flat roof. That would be an ideal location for an antenna".

"He'll just have to educate the landlord," I replied, "And that may take a lot of time".

Pendergast looked around the shack and his eye fell on the Japanese magazine *CQ Ham Radio*. "Anything interesting about antennas in that magazine?" he asked.

I hefted the May issue in one hand. "Look at that," I said. "You can't doubt that amateur radio is a success in Japan. This issue runs to 520 pages! Fantastic."

"What about antennas," demanded Pendergast, caught in a groove of his own choosing. "They usually have some pretty good information in that publication."

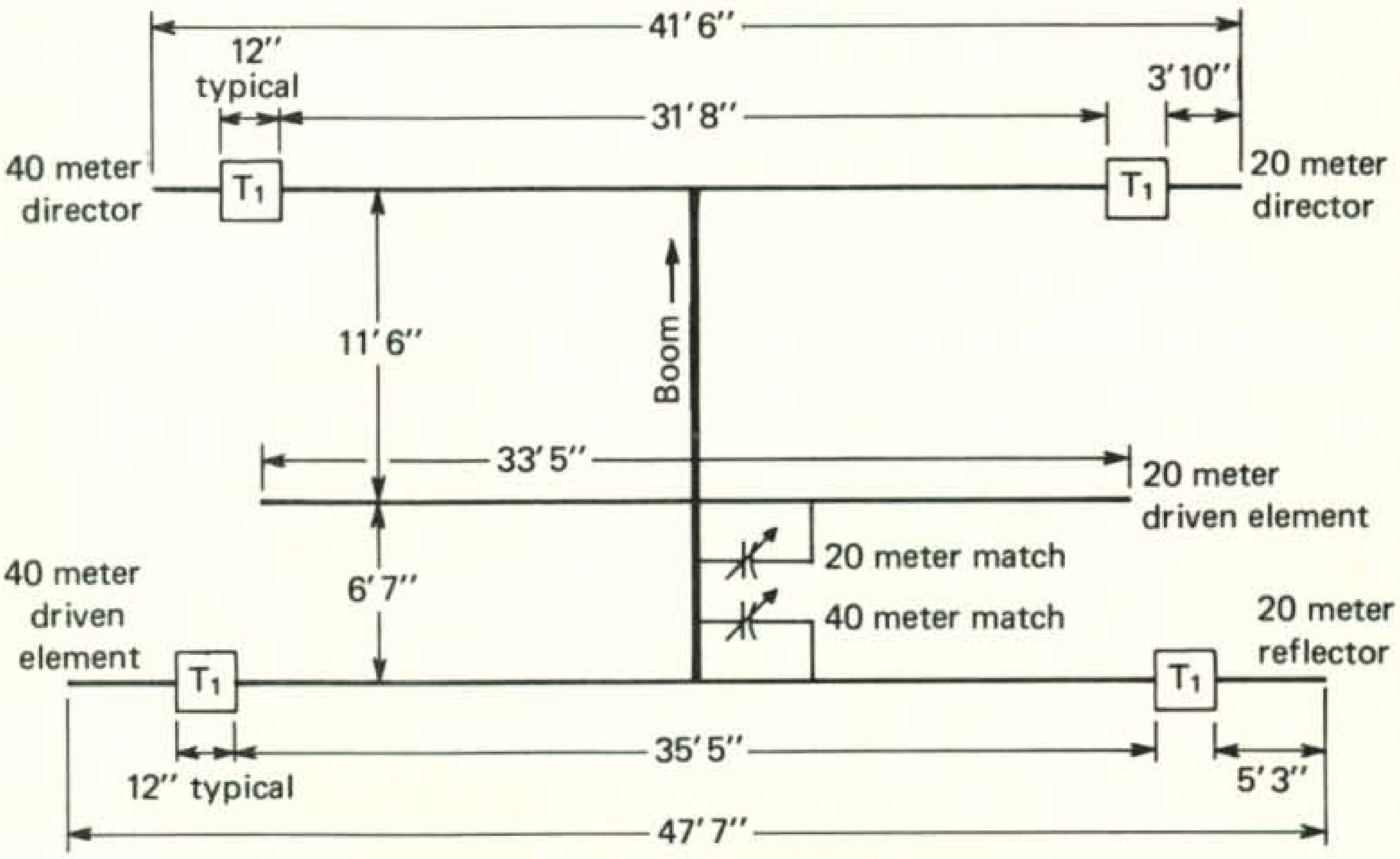
41'6"
12" typical
31'8"
3'10"
40 meter director
T₁
T₁
20 meter director
11'6"
Boom
33'5"
20 meter driven element
6'7"
20 meter match
40 meter match
40 meter driven element
20 meter reflector
T₁
T₁
12" typical
35'5"
5'3"
47'7"

Fig. 7—Dimensions of 20-40 meter duo-band Yagi antenna at JA8JL and JA8AJS. Antenna is fed with a gama match for 40 meters and a modified omega match for 20 meters. See fig. 8 for matching systems. Beam diameter is 2½ inches. Elements are 1¼ inch at center, tapering to ⅞ inch diameter at the tips. Trap information is given in fig. 9.

"You are right," I admitted. "It is a pity I can't read Japanese. But a lot of the information is in English, and all of it is in the metric system. So, with a little guesswork, and a handy pocket calculator, it is possible to squeeze a lot of good information out of the articles."

Pendergast leafed through the magazine. "How about this discussion of a 20-40 meter trapped Yagi by JA8JL and JA8AJS?" he asked.

"That's a good one," I replied. "I've seen very little practical information in print on a two band parasitic array for 20 and 40 meters. This looks like one that will work. "Here's a sketch of the beam (fig. 7). Basically, it is a 3 element Yagi on 14 MHz and a 2 element Yagi on 7 MHz. Bandswitching is accomplished by the use of traps in the 20 meter director and reflector.

"On 20 meters all three elements are used. The center element is the radiator, and the outer elements are the reflector and the director. The antenna is fed with a gamma matching system. On 40 meters, the outer elements take the form of a director and a driven element and the center element is unused.

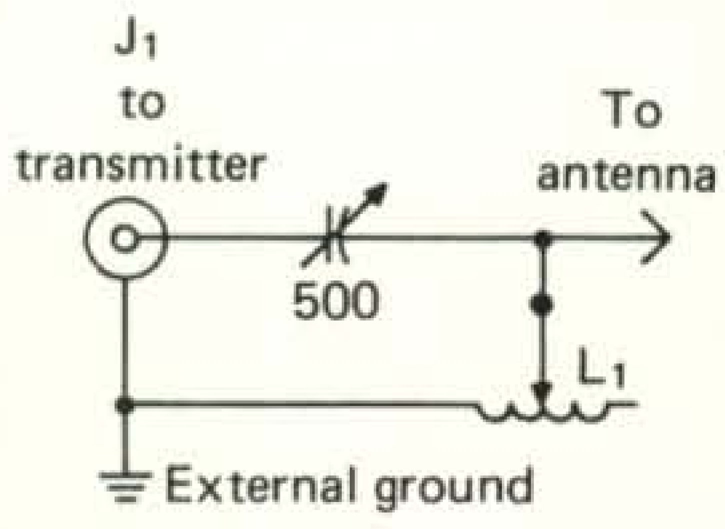
J₁
to
transmitter
To
antenna
500
L₁
External ground

Fig. 6 — The antenna tuner at W0BWJ/6. The capacitor is a double-spaced surplus unit, as is the coil. Tuning unit will match any random wire as long as it is not an exact multiple of quarter wave lengths. If a match cannot be achieved a 500 pf transmitting-type mica capacitor is inserted in the lead to the antenna.

"The center element, then, isn't used on 40 meters, is it?" asked Pendergast.

"Right," I replied. The 20 meter reflector acts as a 40 meter driven element, and the 20 meter director acts as a 40 meter director. In that way, optimum element spacing is maintained for the two bands.

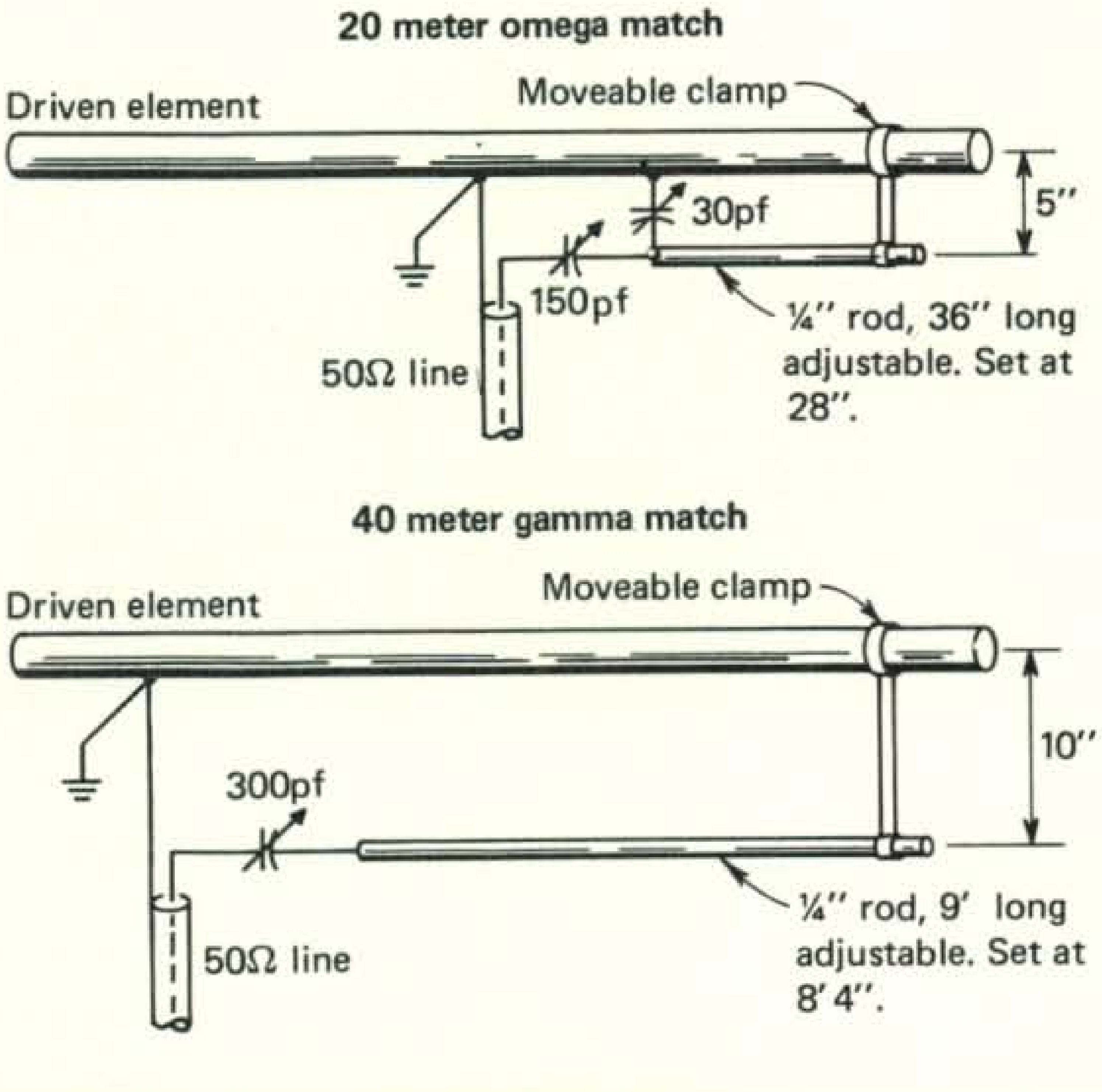
20 meter omega match
Driven element
Moveable clamp
5"
30pf
150pf
50Ω line
¼" rod, 36" long adjustable. Set at 28".
40 meter gamma match
Driven element
Moveable clamp
10"
300pf
50Ω line
¼" rod, 9' long adjustable. Set at 8'4".

Fig. 8—Matching systems for 20-40 meter duo-band Yagi antenna.

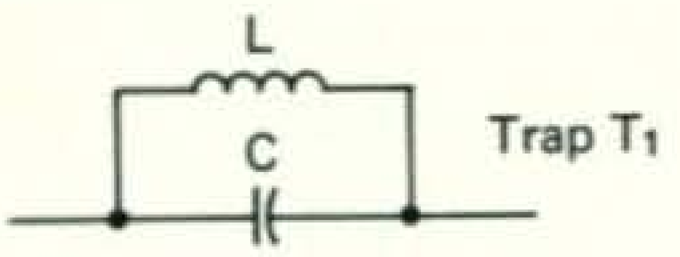

Fig. 9—Trap design for duo-band beam. The capacitor in original design is an aluminum cylinder that slips over the coil to serve as a rain shield. It is made of 2⅜" dia. tubing, 12" long. *L* is approx. 8 μh. 32 turns #20 e. 1⅜" dia. 7" long, space wound. C is 15 pf 10 kv. Adjust L to resonate at 13.8 MHz.

"The boom is 18 feet long. That provides 0.12 wavelength spacing for the 40 meter elements, which is just about right for a 2 element beam. On 20 meters, there are three elements. Spacing between the driven element and the director is 11'6" and spacing between driven element and reflector is 6'6". Those are commonly-used dimensions for a 3 element, 20 meter Yagi. The article claims 6.78 db gain on 14 MHz and 5.5 db gain on 7 MHz. Those figures sound reasonable to me."

"What about the mechanical construction?" asked Pendergast eagerly.

"Well, the elements are made up of aluminum tubing. The center sections are about 1¼" diameter and the elements taper down to ⅞" diameter at the tips. Boom diameter is 2½". All-metal construction is used.

"The two matching systems are shown in fig. 8. The 7 MHz matching device is a simple gamma match and the 14 MHz system uses an omega match. Both of these matching systems are discussed in my *Beam Antenna Handbook*[1].

"How about the traps?" queried my friend, as he wrote furiously in his notebook.

"The traps are all alike, and they are tuned to 13.8 MHz by using a grid-dip meter. The traps are adjusted before being put into the antenna.

"These traps are very interesting, as they are very low-C (fig. 9). That means the inductances are quite large—larger than one would suspect for an antenna of this type. This was done, I am sure, in order to decrease the length of the 40 meter tip sections. After all, the length of the 40 meter driven element is only 47'7" and the director is only 41'6". This is accomplished by using large inductors in the traps which tend to act as loading coils on 40 meters. If the traps had less inductance and more capacitance, the element tips would be longer. It's very simple; the more wire in the trap, the shorter the extension tip."

Pendergast thought a moment, then he asked. "How does this affect 20 meter performance?"

"As far as I know, it has no effect on 20 meter performance. Look at the s.w.r. curve for 20 meter operation (fig. 10). That certainly looks conventional. And the s.w.r. curve for 40 meters is very good, too (fig. 11). Since the element spacing is 0.12 wavelength, it is possible to achieve a relatively good bandwidth performance. Much better, in fact than many of the so-called miniature 40 meter beams on the market. This particular antenna was tuned for the Japanese phone band near 7025 kHz. It should be simple to shorten the tips of the 40 meter sections and move the resonant frequency of the antenna up into the top end of the band. In any event, the director element should be self-resonant about 150 kHz above the resonant point of the driven element for proper operation."

"That looks good," said my friend. "As long as the sunspot count is as low as it is, the interest in 40 and 80 meter DX antennas will remain high. Now, when will you come up with the design of a good, compact 160 meter rotary beam?" ■

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[1] Orr, "Beam Antenna Handbook," 4th edition. Radio Publications, Inc., Box 149, Wilton, Conn. $4.95 plus 25¢ postage and handling.

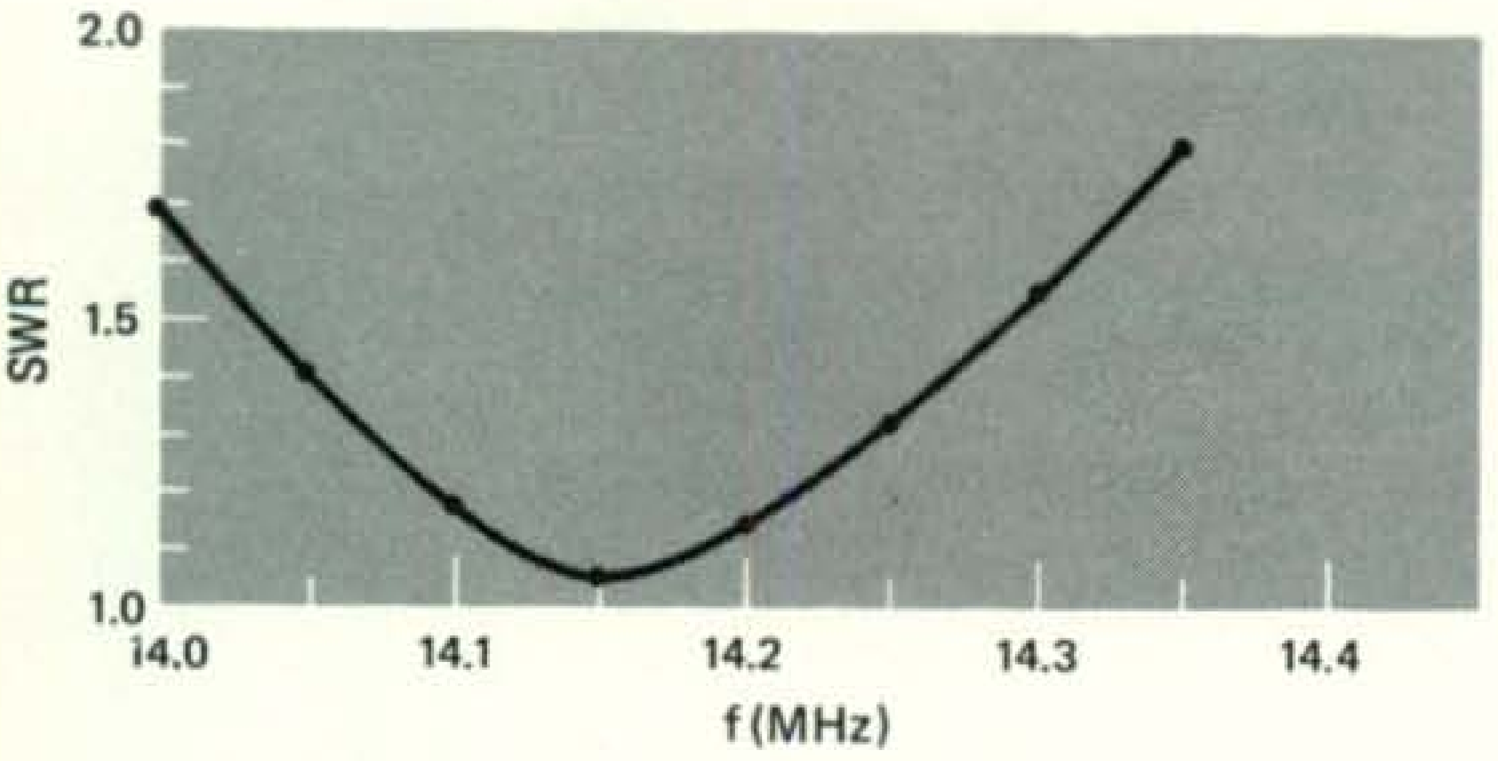

Fig. 10—s.r.w. plot for 20 meters for 40-20 meter Yagi beam.

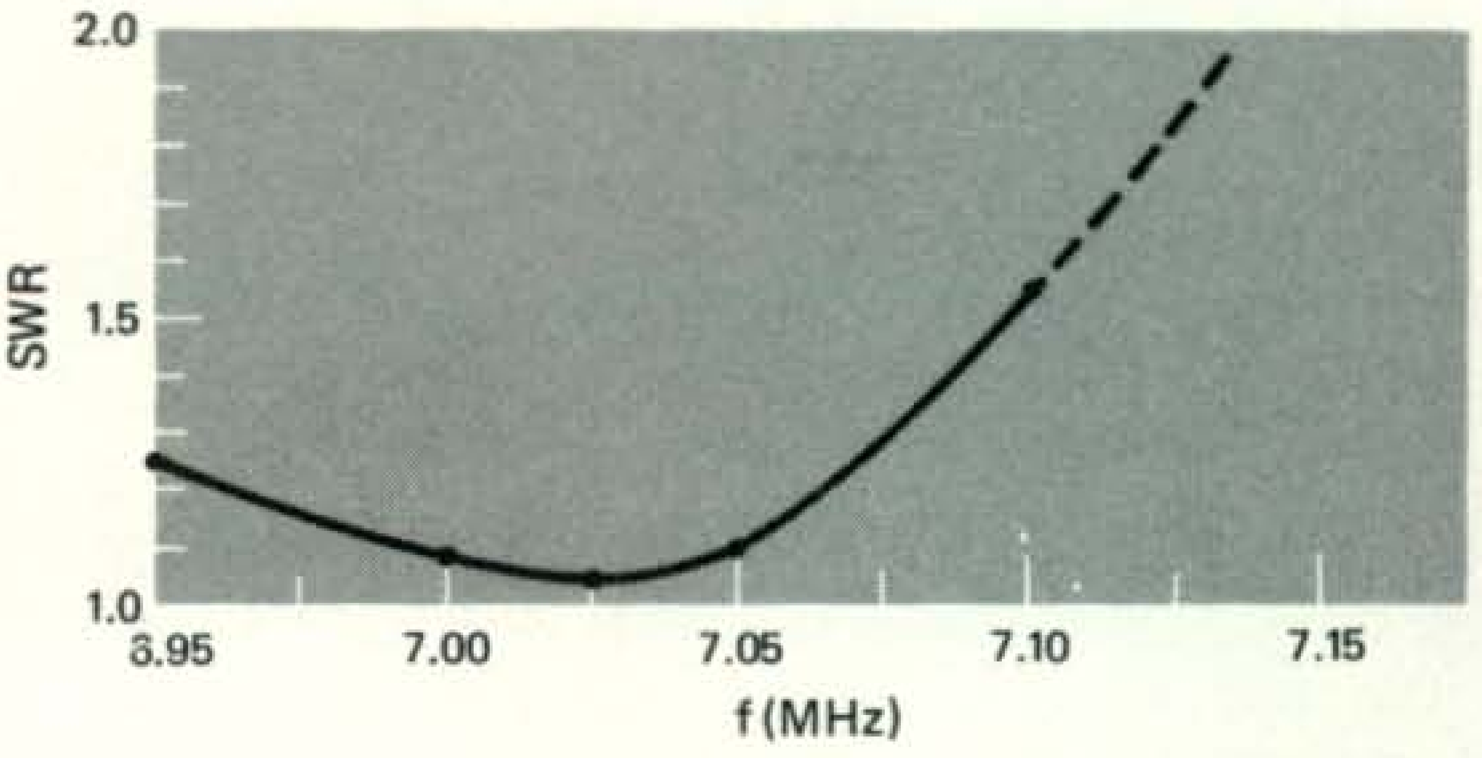

Fig. 11—s.w.r. plot for 40 meters for 40-20 meter Yagi beam.

SEND IN EARLY FOR ALL CQ CONTEST LOG AND SUMMARY SHEETS
include an s.a.s.e. or sufficient IRCs for prompt delivery

MATH'S NOTES

BY IRWIN MATH,* WA2NDM

WHILE discussing several frequency synthesis schemes we came up with an idea that we would like to pass along as "food for thought".

It has occurred to us that, if inexpensive f.m. receivers, of the home entertainment type can be made to "lock onto" a commercial station with no drift to speak of, why can't a similar scheme be developed for amateur f.m. operation where two transmitters and receivers will track each other as accurately as synthesized equipment?

Figure 1 is our quick approach to this scheme.

A standard amateur f.m. receiver is modified so that a d.c. voltage is obtained from the detector that is proportional to the frequency at the received signal in exactly the same manner as an a.f.c. voltage in a home entertainment receiver.

This a.f.c. voltage is, like the home entertainment receiver, also applied to the local oscillator of the receiver, but through an FET sample and hold circuit. This sample and hold circuit is nothing more than a very high quality (low leakage) polystyrene or similar capacitor and an FET type operational amplifier with an extremely high input impedance. The op-amp is connected as a follower and does not appreciably load the "holding capacitor".

The output of the op-amp is fed to the local oscillator for frequency correction in the conventional manner.

In addition, the output of the op-amp is also fed to a "fine tuning" varicap in the transmitter's v.f.o. Operation of the system is as follows:

When a signal is received, it is first tuned in with the a.f.c. switch in the OFF position in the normal manner. Note that the local oscillator and transmitter fine-tune varicap are both biased to the center of their range. Now, the a.f.c. switch is turned ON and the a.f.c. circuit "holds" the received signal in the conventional manner. At the same time as one is listening, it is customary to "Zero-beat" the received signal with the transmitter's v.f.o. Once this is done, the fine-tuning varicap in the v.f.o. keeps it fine-tuned to the received frequency even as the receiver drifts.

Now, when switching to TRANSMIT, the a.f.c. voltage from the detector is removed but the holding capacitor keeps the receiver and transmitter tuned to the exact last frequency received. The other station now takes over and locks its receiver and transmitter to the signal being transmitted in the same manner.

As long as the capture range and fine-tuning range of the a.f.c. circuitry is not exceeded, the two stations thus controlled will be locked with each other and will even drift together thereby giving a pseudo-synthesized stability effect.

We must caution that none of this has been tried by us nor even researched very closely at this time. It would be interesting to hear from other amateurs on their impressions of this scheme and we will, as usual publish follow-up information as we receive it.

In our June column which we devoted to

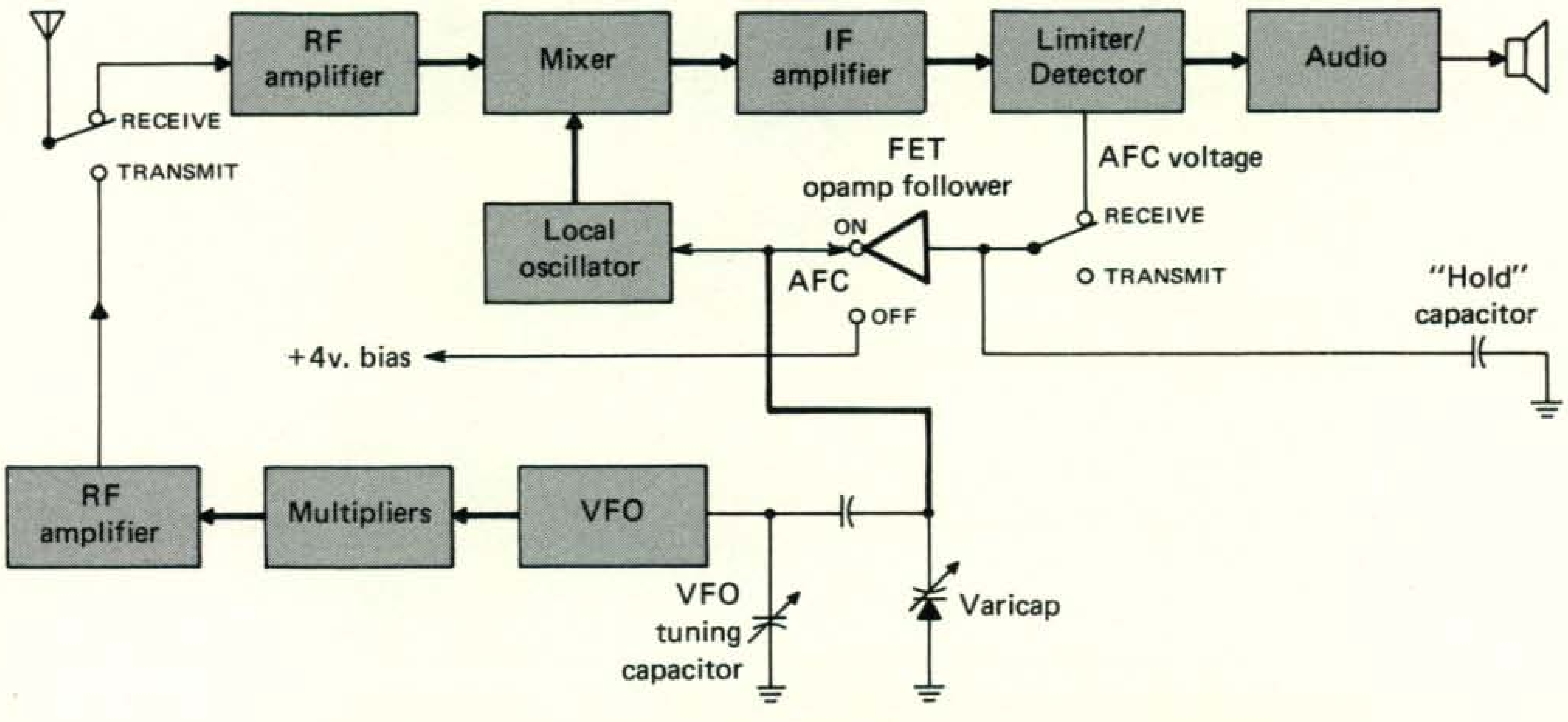

Fig. 1—The proposed "pseudo-synthesis" scheme discussed in the text.

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*5 Melville Lane, Great Neck, N.Y. 10023.

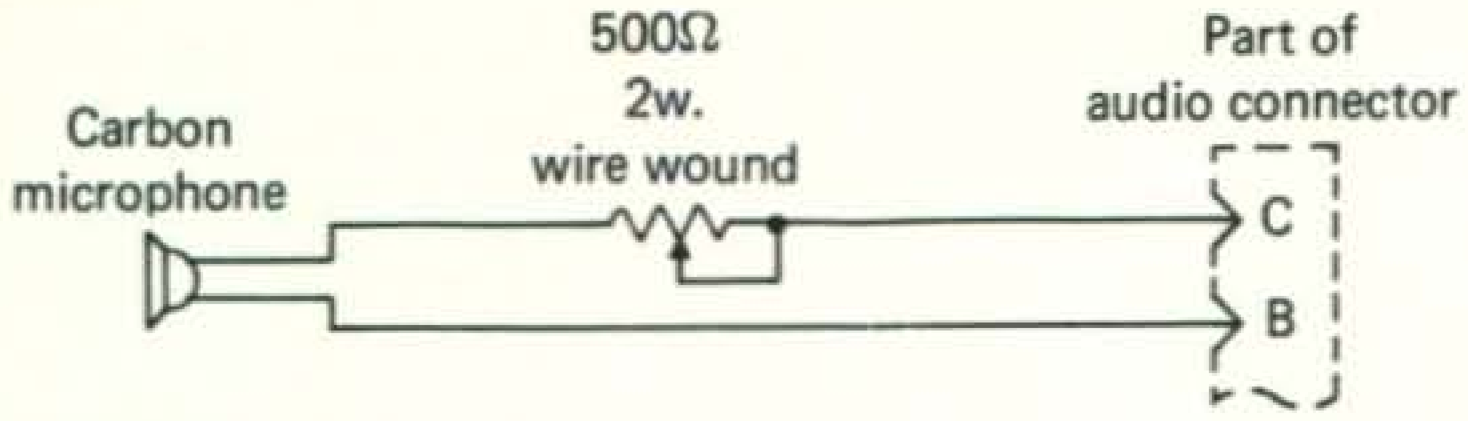

500Ω
2w.
wire wound
Carbon
microphone
Part of
audio connector
C
B

Fig. 2—The added 500 ohm pot should be adjusted to allow ±5 kHz deviation.

the RT-70/GRC transceiver, we received a rather large number of letters expressing interest in the unit.

At this time therefore, we would like to pass along some additional information, primarily suppled by Mike Strange WA2BHB, who has converted four of the units. According to him:

1. N.b.f.m. can be received without the use of the IC detector we recommended, simply by re-aligning the discriminator circuit (L_{116} and L_{117} which are part of T_{106}).

2. A pot in the microphone lead, as shown in fig. 2, works nicely to allow 5kHz deviation.

3. Sensitivity of the RT-70 without a preamp seems about equal or better than existing older commercial gear.

4. To operate a.m., use the RT-70 as a driver for a class C modulated amplifier. A.m. reception can be achieved by either off-balancing one of the discriminator coils or adding a conventional diode detector at the output of the 4th i.f. stage.

5. Finally, if low sensitivity is noted, run the entire low voltage line at 7 volts instead of the 6.3 volts specified. Do not exceed 7 volts however.

Thanks again for the information Mike.

Since our June column, we have also put an RT-70 on the air. Fig. 3 is a schematic of the power supply we used. Note that pin H of the power connector is tied to +90V. We inadvertently left this connection out of our schematic in the June column. The NPN power transistors used in the power supply may be any similar device with an Hfe of 30 or more, a Vce of 50 volts or more and the ability to switch reliably at 20khz (an Ft spec. of ½ MHz or so is fine). Be sure to very carefully wind the toroid. It is a tedious job but the 83% efficiency of our H.V. supply makes it well worth while.

We mounted our entire H.V. supply and the Zener on a 1½ x 2″ piece of 1/16″ phenolic board with the power transistors heat sunk to the chassis. We then removed P_1 and J_1 on the transmitter sub-chassis, spliced all of the wires, previously connected through them together and mounted the power supply board in the space made available using the mounting holes from J_1 and some home made angle brackets.

Putting the unit on the air proved no problem at all and the audio stage drove an 8 ohm 3″ PM speaker directly with reasonable volume although severly mismatched. A pair of 600 ohm earphones gave ear-splitting volume.

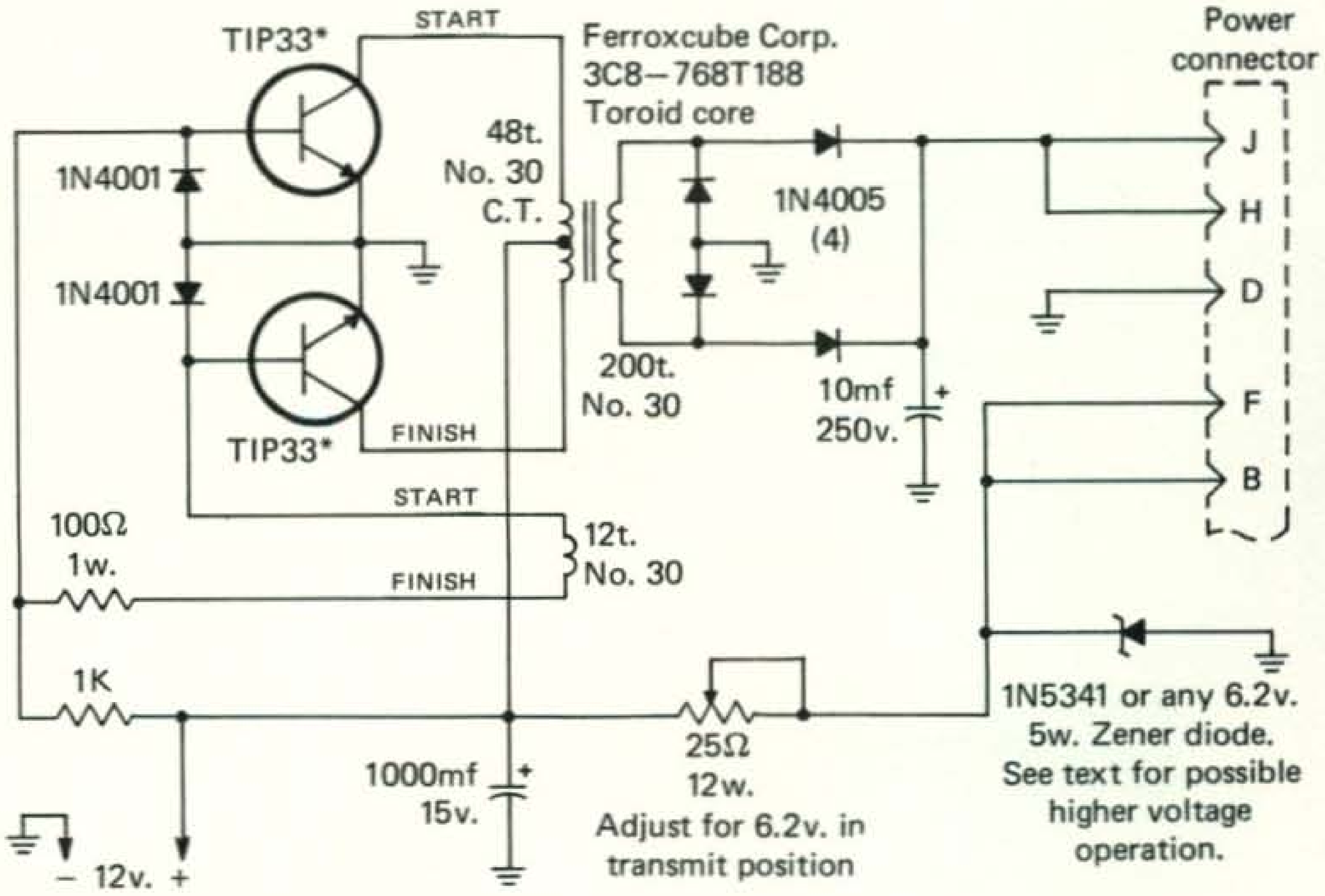
Calibration of the dial on our RT-70 was as accurate as one could expect to read. The scale and the dial locks (pre-set knobs) were set to either end of the band as reference points.

Sensitivity after touching up the i.f.'s slightly (no more than ±⅛ of a turn was necessary) was about ½ microvolt for 16db of quiting.

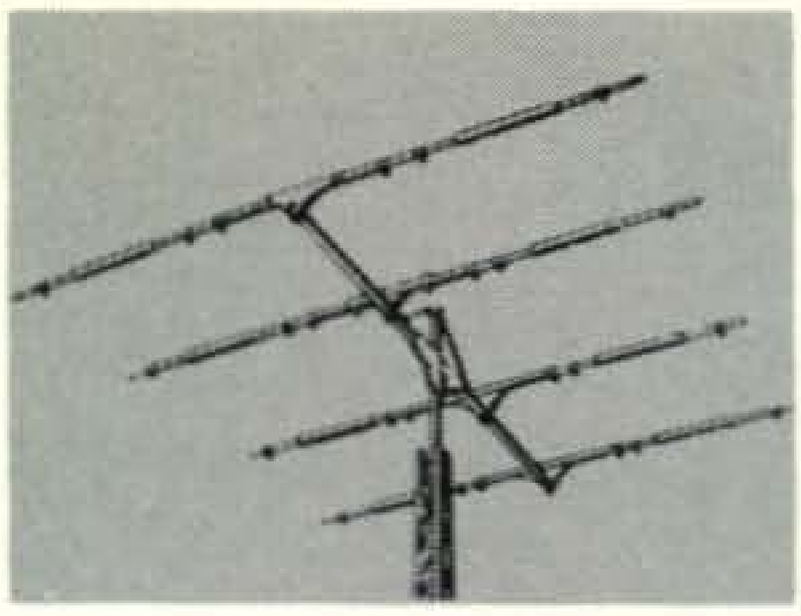
Considering that one need not even open an RT-70, but can do all of the "work" outside, we are even more convinced of its usefulness on 6 for mobile or even fixed station use with a beam.

[*Continued on page 80*]

Fig. 3—The power supply for the RT-70 transceiver discussed in the text. Note that the high frequency of operation (20 kHz) only requires a 10 μf capacitor for adequate filtering.


TIP33*
START
Ferroxcube Corp.
3C8–768T188
Toroid core
Power
connector
48t.
No. 30
C.T.
1N4001
1N4005
(4)
J
H
1N4001
D
200t.
No. 30
10mf
250v.
F
TIP33*
FINISH
B
START
100Ω
1w.
12t.
No. 30
FINISH
1K
25Ω
12w.
Adjust for 6.2v. in
transmit position
1000mf
15v.
1N5341 or any 6.2v.
5w. Zener diode.
See text for possible
higher voltage
operation.
– 12v. +

* Texas Instruments heat sink to chassis with insulating washers supplied.



HOT COMBO

Element for element, our rugged High-Q beam antennas are designed to give you the biggest signal your transmitter is capable of.

Now when you install one of these Swan antennas you can make sure you're running full bore all the time by hooking our new SWR/RF Power meter in the coax.

Heavy duty 4-element Tribander Four elements work on 10, 15 and 20 meters. Optimum spacing for maximum performance. Precision tuned, weatherproof traps. 100-mph winds. TB-4HA. *$249.95*

Heavy duty 3-element Tribander Three elements work on 10, 15 and 20 meter bands. Rugged construction. Precision tuned, weatherproof traps. Excellent performance on lighter tower. TB-3HA. *$189.95*

Economy 2-element Tribander Light enough for standard TV rotator but withstands 80 mph winds. Two working elements on 10, 15 and 20 meters. TB-2A. *$129.95*

Heavy duty 2-element 40-meter Beam Two elements on steel beam. Maximum performance for 40-meter CW or phone. Big, weatherproof high-Q loading coils. Easily takes 100 mph winds. MB-40H. *$199.95*

SWR/RF Power meter Combination meter measures standing wave ratio **and** antenna power. Low insertion loss lets you leave it in circuit. 3.5 to 150 MHz. *$21.95*

All Swan Beam Antennas are Rated for 2000 Watts and designed to use 52 Ohm coaxial feedlines.

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Antenna Model Number	Average Forward Gain	Front to Back Ratio	Boom Length & Diameter	Longest Element	Turning Radius	Maximum Wind Survival	Wind Load @ 80 mph	Wind Surface Area	Net Weight
TB-4HA	9 dB	24-26 dB	24' x 1.5"	28'-10"	18'-6"	100 mph	148 lbs.	6 sq. ft.	54 lbs.
TB-3HA	8 dB	20-22 dB	16' x 1.5"	28'-2"	16'	100 mph	110 lbs.	4 sq. ft.	44 lbs.
TB-2A	5 dB	16-18 dB	6.5' x 1.5"	27'-8"	14'-3"	80 mph	60 lbs.	1.8 sq. ft.	18 lbs.
MB-40H	4 dB	16-18 dB	15.75' x 1.5"	30'-4"	17'-6"	100 mph	80 lbs.	2.5 sq. ft.	40 lbs.

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1975 CQ World-Wide DX Contest

Phone: October 25-26 & C.W.: November 29-30
Starts 0000 GMT Sat. Ends 2400 GMT Sun.

I. OBJECTIVE: For amateurs around the world to contact other amateurs in as many zones and countries as possible.

II. BANDS: All bands, 1.8 thru 28 mHz.

III. TYPE OF COMPETITION: 1. Single Operator. Single Band & All Band.

2. Multi-Operator (all band operation only).

a. Single Transmitter, only one transmitter and one band permitted during the same time period (defined as 10 minutes). *Exception:* One—and only one—other band may be used during the same time period if—and only if—the station worked is a new multiplier.

b. Multi Transmitter (no limit to transmitters but only one signal per band permitted).

IV. NUMBER EXCHANGE: PHONE: RS report plus zone (i.e.: 5705). C.W.: RST report plus zone (i.e.: 57905).

V. MULTIPLIER: Two types of multiplier will be used.

1. A multiplier of one (1) for each different zone contacted on each band.

2. A multiplier of one (1) for each different country contacted on each band.

Stations are permitted to contact their own country and zone for multiplier credit. The *CQ* Zone Map, DXCC country list, WAE country list and WAC boundaries are standards.

VI. POINTS: 1. Contacts between stations on different continents are worth three (3) points.

2. Contacts between stations on the same continent but different countries, one (1) point. *(Exception:* For North American stations *only*, contacts between stations within the North American boundaries count two (2) points.

3. Contacts between stations in the same country are permitted for zone or country multiplier credit but have zero (0) point value.

VII. SCORING: All stations: the final score is the result of the total QSO points multiplied by the sum of your zone and country multiplier.

Example: 1000 QSO points × 100 multiplier (30 Zones + 70 Countries) = 100,000 (final score).

VIII. AWARDS: First place certificates will be awarded in each category listed under Sec. III in every participating country and in each call area of the United States, Canada, Australia and Asiatic USSR.

All scores will be published. To be eligible for an award a Single Operator station must show a minimum of 12 hours of operation. Multi-operator stations must operate a minimum of 24 hours. A single-band log is eligible for a single-band award *only*. If a log contains more than one band it will be judged as an all-band entry, unless specified otherwise.

In countries or sections where the returns justify, 2nd and 3rd place awards will be made.

All certificates will be issued to the licensee of the station used.

IX. TROPHIES & PLAQUES: Handsome trophy awards will be made to the highest scoring stations in the following categories.

Single Operator, All Band Trophy Donors

1. World—Phone *(Bill Leonard, W2SKE)*
2. World—C.W. *(Larry LeKashman, W2AB)*
3. USA—Phone *(Potomac Valley Radio Club)*
4. USA—C.W. *(Frankford Radio Club)*
5. Canada—Phone *(Jack Baldwin, VE3BS)*
6. Europe—Phone *(W4BVV Operators)*
7. Europe—C.W. *(W3AU Operators)*
8. Carib./C.A.—Phone *(Don Wallace, W6AM)*
9. Carib./C.A.—C.W. *(Don Wallace, W6AM)*
10. Africa—Phone *(Gordon Marshall, W6RR)*
11. Africa—C.W. *(Gordon Marshall, W6RR)*
12. Asia—Phone *(Japan CQ Magazine)*
13. Asia—C.W. *(Japan CQ Magazine)*
14. Oceania—Phone *(N. Calif. DX Club)*
15. Oceania—C.W. *(Maui A.R.C.)*

Single Operator, Single Band Trophy Donors

16. World—Phone *(K2HLB Memorial Trophy—N. Jersey DX Assn.)*
17. World—C.W. *(W2JT Memorial Trophy—N. Jersey DX Assn.)*
18. Canada—Phone *(Gene Krehbiel, VE7KB)*
19. Carib./C.A. — Phone *(Pedro Piza, Jr., KP4AST)*
20. S. America—Phone *(Brazil DXers)*
21. Europe—14 MHz C.W. *(G2LB Memorial Trophy—From his friends)*
22. USA—Phone *(S. Calif. DX Club)*
23. USA—C.W. *(N. Ill. DX Club)*

Multi-Operator, Single Trans. Trophy Donors

24. World—Phone *(John Knight, W6YY)*
25. World—C.W. *(Anthony Susen, W3AOH)*
26. Canada—Phone *(Calgary A.R.A.)*

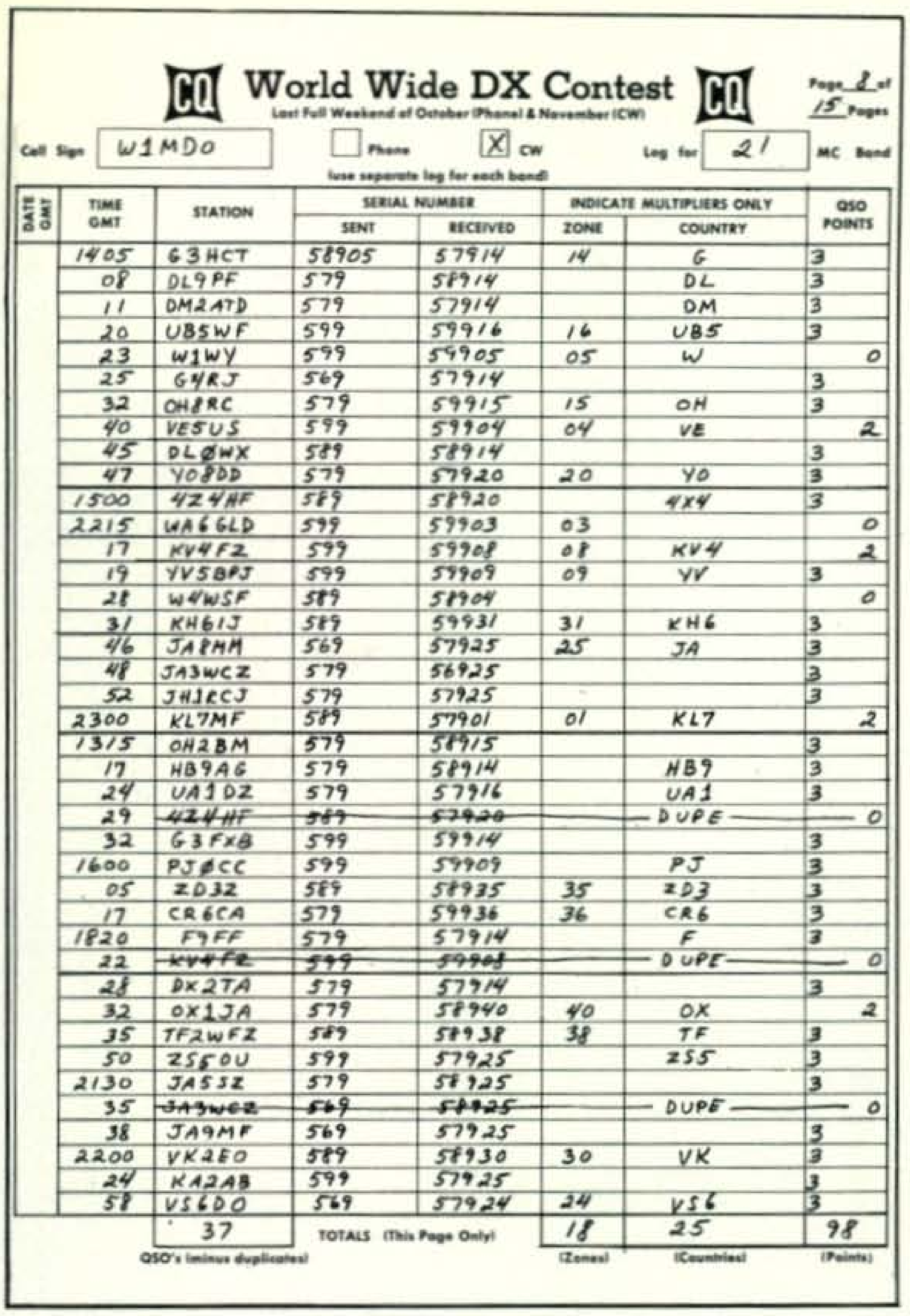
Multi-Operator, Multi-Trans. Donors

27. World—Phone *(Radio Club Venezolano)*
28. World—C.W. *(Hazard Reeves, K2GL)*

Contest Expedition Trophy Donors

29. World—Phone *(Stuart Meyer, W2GHK)*
30. World—C.W. *(K2HLB Memorial Trophy—Don Miller, W9WNV)*

Trophy winners may win the same trophy only once within a three year period. (This does



CQ World Wide DX Contest CQ

Last Full Weekend of October (Phone) & November (CW)

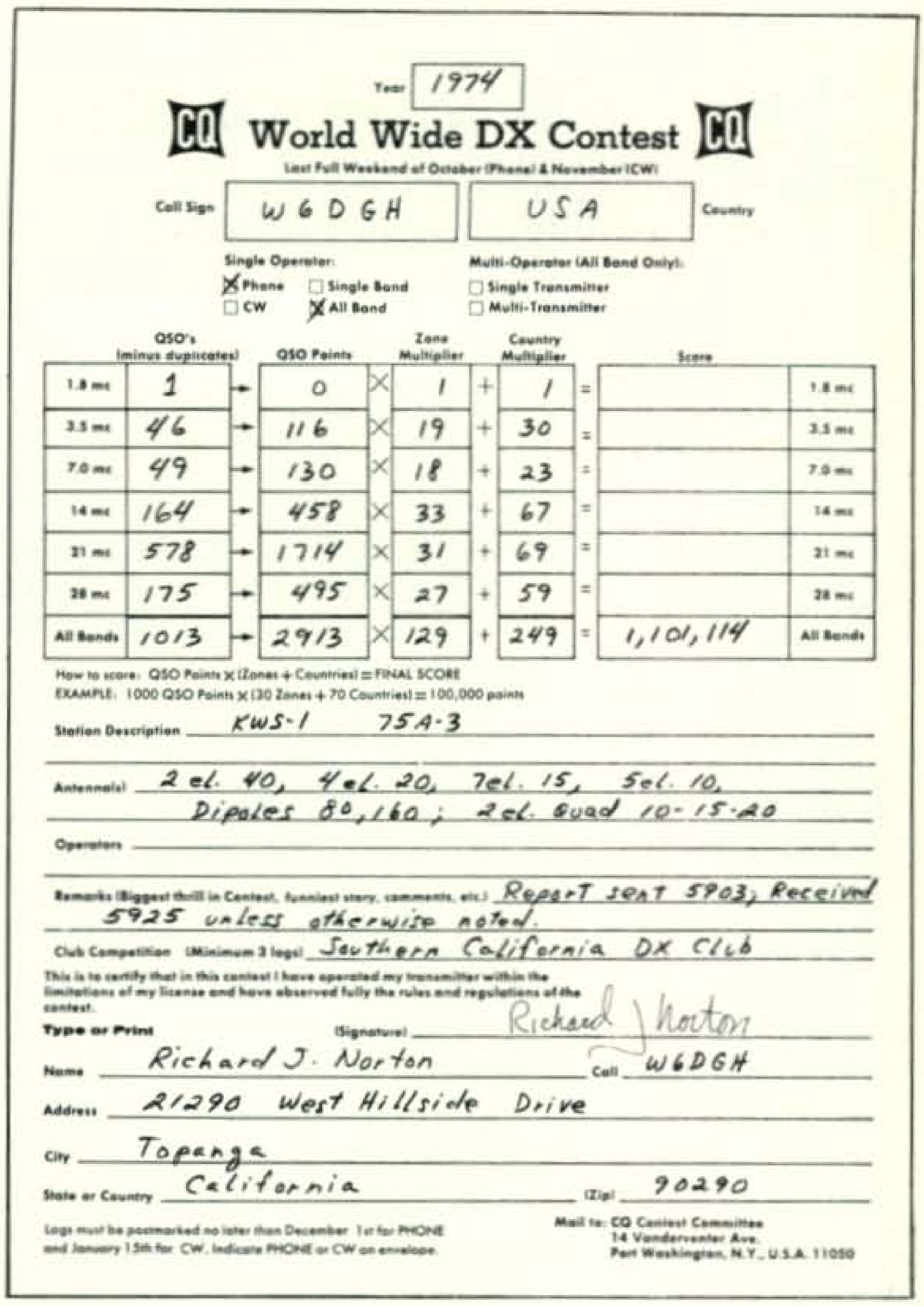
Page 2 of 15 Pages

Call Sign W1MDO ☐ Phone ☒ CW Log for 21 MC Band

(use separate log for each band)

DATE GMT	TIME GMT	STATION	SERIAL NUMBER SENT	SERIAL NUMBER RECEIVED	INDICATE MULTIPLIERS ONLY ZONE	INDICATE MULTIPLIERS ONLY COUNTRY	QSO POINTS
	1405	G3HCT	58905	57914	14	G	3
	08	DL9PF	579	58914		DL	3
	11	DM2ATD	579	57914		DM	3
	20	UB5WF	599	59916	16	UB5	3
	23	W1WY	599	59905	05	W	0
	25	G4RJ	569	57914			3
	32	OH8RC	579	59915	15	OH	3
	40	VE5US	599	59904	04	VE	2
	45	DL0WX	589	58914			3
	47	YO8DD	579	57920	20	YO	3
	1500	4Z4HF	589	58920		4X4	3
	2215	WA6GLD	599	59903	03		0
	17	KV4FZ	599	59908	08	KV4	2
	19	YV5BPJ	599	59909	09	YV	3
	28	W4WSF	589	58904			0
	31	KH6IJ	589	59931	31	KH6	3
	46	JA8MM	569	57925	25	JA	3
	48	JA3WCZ	579	56925			3
	52	JH1RCJ	579	57925			3
	2300	KL7MF	589	57901	01	KL7	2
	1315	OH2BM	579	58915			3
	17	HB9AG	579	58914		HB9	3
	24	UA1DZ	579	57916		UA1	3
	29	~~4Z4HF~~	~~589~~	~~57920~~		DUPE	0
	32	G3FXB	599	59914			3
	1600	PJ0CC	599	59909		PJ	3
	05	ZD3Z	589	58935	35	ZD3	3
	17	CR6CA	579	59936	36	CR6	3
	1820	F9FF	579	57914		F	3
	22	~~KV4FZ~~	~~599~~	~~59908~~		DUPE	0
	28	DX2TA	579	57914			3
	32	OX1JA	579	58940	40	OX	2
	35	TF2WFZ	589	58938	38	TF	3
	50	ZS5OU	599	57925		ZS5	3
	2130	JA5SZ	579	58925			3
	35	~~JA3WCZ~~	~~569~~	~~58925~~		DUPE	0
	38	JA9MF	569	57925			3
	2200	VK2EO	589	58930	30	VK	3
	24	KA2AB	599	57925			3
	58	VS6DO	569	57924	24	VS6	3
		37 QSO's (minus duplicates)	TOTALS (This Page Only)		18 (Zones)	25 (Countries)	98 (Points)

A sample log page.



Year 1974

CQ World Wide DX Contest CQ

Last Full Weekend of October (Phone) & November (CW)

Call Sign W6DGH USA Country

Single Operator: ☒ Phone ☐ CW ☐ Single Band ☒ All Band

Multi-Operator (All Band Only): ☐ Single Transmitter ☐ Multi-Transmitter

	QSO's (minus duplicates)		QSO Points		Zone Multiplier		Country Multiplier		Score	
1.8 mc	1	→	0	×	1	+	1	=		1.8 mc
3.5 mc	46	→	116	×	19	+	30	=		3.5 mc
7.0 mc	49	→	130	×	18	+	23	=		7.0 mc
14 mc	164	→	458	×	33	+	67	=		14 mc
21 mc	578	→	1714	×	31	+	69	=		21 mc
28 mc	175	→	495	×	27	+	59	=		28 mc
All Bands	1013	→	2913	×	129	+	249	=	1,101,114	All Bands

How to score: QSO Points × (Zones + Countries) = FINAL SCORE

EXAMPLE: 1000 QSO Points × (30 Zones + 70 Countries) = 100,000 points

Station Description KWS-1 75A-3

Antenna(s) 2 el. 40, 4 el. 20, 7el. 15, 5el. 10,
Dipoles 80, 160; 2el. Quad 10-15-20

Operators

Remarks (Biggest thrill in Contest, funniest story, comments, etc.) Report sent 5903; Received 5925 unless otherwise noted.

Club Competition (Minimum 3 logs) Southern California DX Club

This is to certify that in this contest I have operated my transmitter within the limitations of my license and have observed fully the rules and regulations of the contest.

Type or Print (Signature) Richard J Norton

Name Richard J. Norton Call W6DGH

Address 21290 West Hillside Drive

City Topanga

State or Country California (Zip) 90290

Logs must be postmarked no later than December 1st for PHONE and January 15th for CW. Indicate PHONE or CW on envelope.

Mail to: CQ Contest Committee
14 Vanderventer Ave.
Port Washington, N.Y., U.S.A. 11050

A sample summary sheet.

not apply to any of the *CQ* plaque awards).

The Canadian, Carib. C.A. and the African awards are for residents *only*.

X. CLUB COMPETITION: *CQ* will award a handsome plaque to the club submitting the highest aggregate score of the phone and c.w. scores submitted by its members.

1. The club must be a local group and not a national organization.

2. Participation is limited to members operating within a local geographic area, (except for DX-peditions especially organized for operation in the contest and manned by members.

3. To be listed, a minimum of 3 logs must be received from a club and an officer of the club must submit a list of participating members and their scores, both on phone and c.w.

XI. LOG INSTRUCTIONS: 1. All times must be in GMT.

2. Indicate zone and country multiplier only the FIRST TIME it is worked on each band.

3. Logs must be checked for duplicate contacts, correct QSO points and multipliers, and recopied logs must be in their original form with corrections clearly shown.

4. Use a separate sheet for each band.

5. Each entry must be accompanied by a Summary Sheet showing all scoring information, category of competition, contestant's name and address in BLOCK LETTERS and a signed declaration that all contest rules and regulations for amateur radio in the country of operation have been observed.

6. Official log and summary sheets and zone maps are available from *CQ*. A *large* self-addressed envelope with sufficient postage or IRC's must accompany your request.

If official forms are not available, make up your own by following the samples shown, 40 contacts to the page on 8½" x 11" paper.

XII. DISQUALIFICATION: Violation of amateur radio regulations in the country of the contestant, or the rules of the contest, unsportsmanlike conduct; taking credit for excessive duplicate contacts; unverifiable QSO's or unverifiable multipliers will be deemed sufficient cause for disqualification. (Incorrectly logged calls will be counted as unverifiable contacts.)

Disqualification can also result in the disqualified operator(s) being barred from competition in all *CQ* contests for a period of up to three years.

Actions and decisions of the *CQ* Contest Committee are official and final.

XIII. DEADLINE: All entries must be postmarked NO LATER than December 1, 1975 for the Phone section and January 15, 1976 for the C.W. section. Indicate phone or c.w. on envelope. Logs go to:

CQ WW Contest Committee
14 Vanderventer Avenue
Port Washington, L.I., N.Y. USA 11050

DeWitt In Focus

BY BILL DEWITT,* W2DD

DON Miller's W9NTP/CE0 operation from Easter Island was a delight to SSTVers all over the globe. Although there still isn't any DXCC /SSTV certificate, Don provided a welcome addition to the "Countries List". At this writing I don't have the total of Don's SSTV conacts, but my guesstimate would be over 1000.

Despite the efforts of a sick-minded individual who seemed determined to prevent my (and other) SSTV exchange(s) with W9NTP/CE0, I was able to secure good evidence of our QSO as shown in the accompanying photos of scan converted images displayed on a Panasonic monitor. Using the Hughes Aircraft Company's Model MSC-1 Storage Tube Scan Converter, the poor quality single frames shown in figures 1 and 2 were combined to produce the better quality picture of fig. 3. Storage tube scan converters have the advantageous capability of integrating two or more frames of incomplete information to produce one frame of improved quality. The integration is performed by "writing" two or more frames on the storage tube target with the sensitivity of the system reduced to prevent "overwriting." The analog response (signal output) of the storage tube then becomes the integrated value of the brightness levels incident upon each point in the total scanning of the target.

During the past two years I have used this interesting and somewhat unique capability of the storage tube scan converter almost innumerable times to produce satisfactory images from two or more frames of SSTV received under adverse conditions. (See "Storage Tube Scan Conversion" by W2DD in the October 1973 issue of *CQ*.) I am sure that this type of averaging or integrating has been used in connection with large scale programs of Earth photography from space, but I wonder who will be the first amateur to extract an EME SSTV or FSTV signal from noise by the use of a storage tube or other analog device. Signal processing can be rewarding.

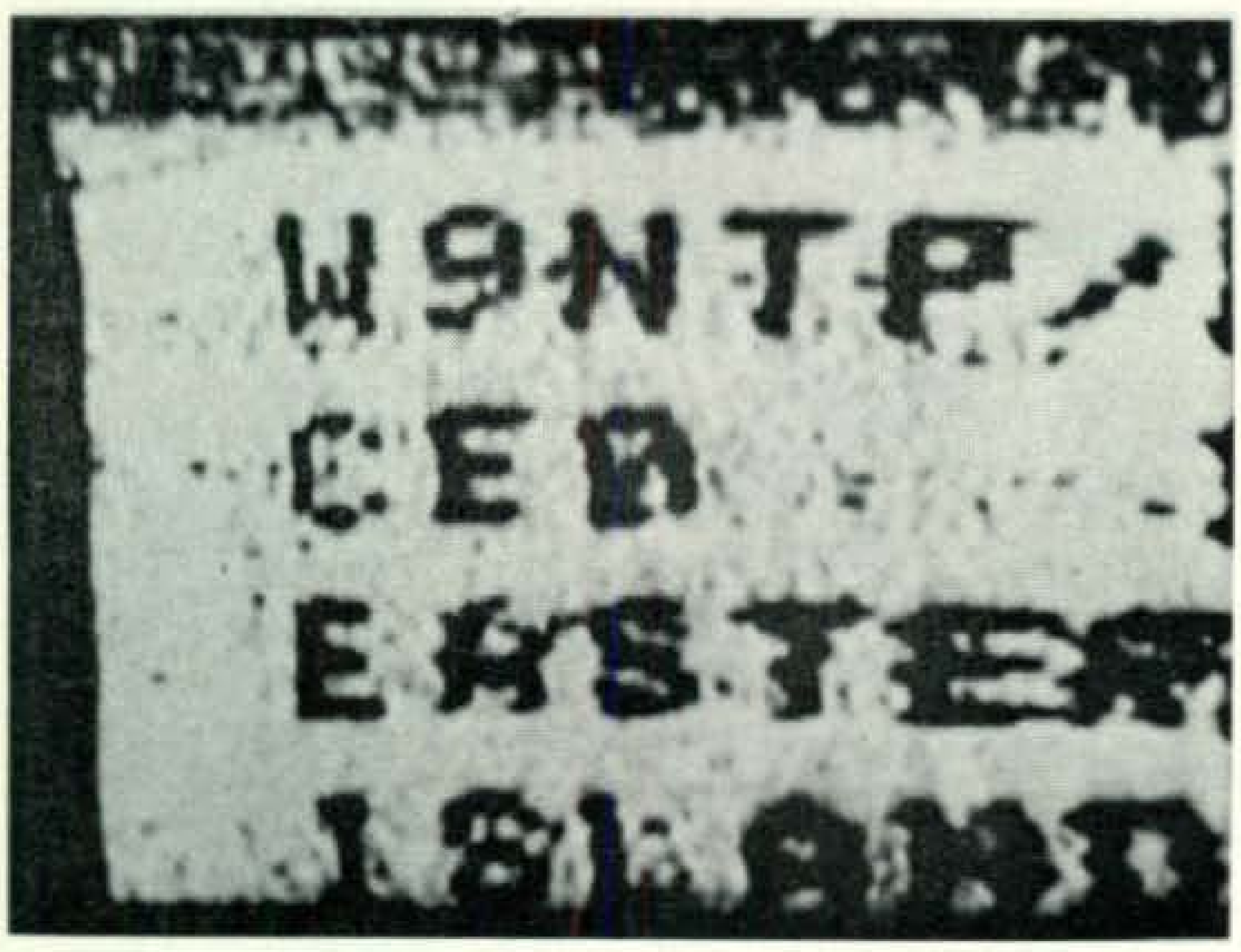


Fig. 1—A single frame view of information received from W9NTP/CE0.

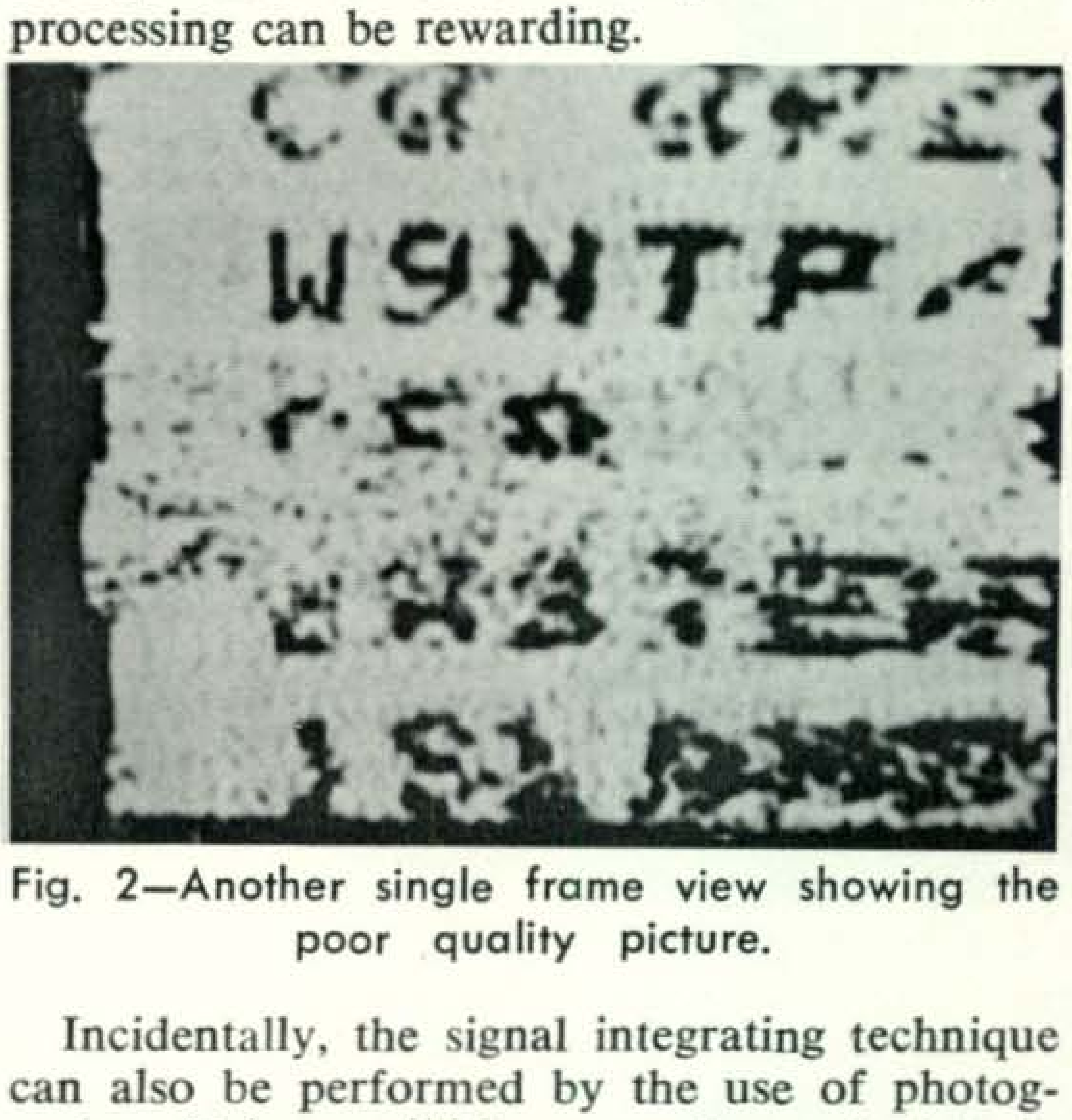


Fig. 2—Another single frame view showing the poor quality picture.

Incidentally, the signal integrating technique can also be performed by the use of photography. This possibility was demonstrated in the (W2DD) article "Slow Scanning Color" which appeared the September 1972 issue of this magazine. However, I think that its use for EME work is unlikely!

Maybe this is a good time to consider those readers who are wondering, "What the devil is a storage tube?—And why is DeWitt all psyched-up over them anyway?" Here's a multiple-choice answer for you: a. Read "Storage Tube Scan Conversion" mentioned above; b. Read the next paragraph: c. Read both.

You may consider a storage tube as an electronic blackboard. You can write on it (electronically), you can read what you have written, and you can erase it. All bottled up in a small glass envelope and looking very much like a vidicon is a target (blackboard), an electron gun (chalk), and some focussing and control elements (that's *you*). In SSTV applications, the beam of the gun sweeps the target at slow scan rates and creates a charge in proportion to the brightness modulation derived from the original scene. When appropriate changes are made in the control voltages applied to the tube elements, the mode of operation changes from "writing" to "reading" and an output signal is available for display at fast scan rates on a conventional monitor. Another change in control voltages switches the tube to the "erase" mode and the electronic blackboard is again ready to "write" another picture or message.

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*2112 Turk Hill Road, Fairport, NY 14450.

Storage tube scan converters have been and still are in the commercially built domain. Converters of varying degrees of sophistication have been marketed by Hughes, RCA, Princeton Electronics, and a few others for years. Commercial applications are varied. Among the newer uses is a Bendix X-ray scanning luggage surveillance device which incorporates a storage tube made by Hughes. Robot Research is the first company to produce a scan converter aimed at the amateur market. The heart of their Model 300 fast to slow—slow to fast converter is the RCA CC-22041 Storage-Display tube.

High cost and lack of availability of storage tubes has inhibited their use by amateurs. A few years ago I would have guessed that by this time some "fall-outs" or "seconds" would have reached the surplus market, but this is not the case.

I am not suggesting that if these tubes were available that the average amateur could "throw together" a storage tube scan converter. However, it is a bit frustrating to think that anyone who has both an SSTV monitor and a "regular" TV set has a good share of the basic requirements at hand. The slow sweeps are present in the SSTV monitor, the fast sweeps in the TV set. The brightness modulation is available at the cathode of the SSTV CRT. Signal levels would have to be adjusted, control voltages and control logic provided—and of course, that STORAGE TUBE! Well, I guess this is an academic discussion until someone makes some tubes available. Does anyone have a source?

What about Charge-Coupled and Charge-Injected Devices (CCDs and CIDs)? What are they—and are they available to Amateurs for homebrewing a scan converter?

CCDs and CIDs are solid state devices, generally in the form of an array of elements, say 100×100 or more. In addition to many other uses, they can be used as an image sensor (TV camera) or for signal processing (scan conversion). In the latter case the signal is not light-induced but may be introduced by a standard MOS element and then passed along by pulsing the electrodes in the proper sequence. Let me emphasize that CCDs and CIDs are similar, NOT identical. (See *Electronics Magazine* Aug. 8, 1974 and *Optical Spectra,* March 1974 for comprehensive descriptions and lists of other applications.)

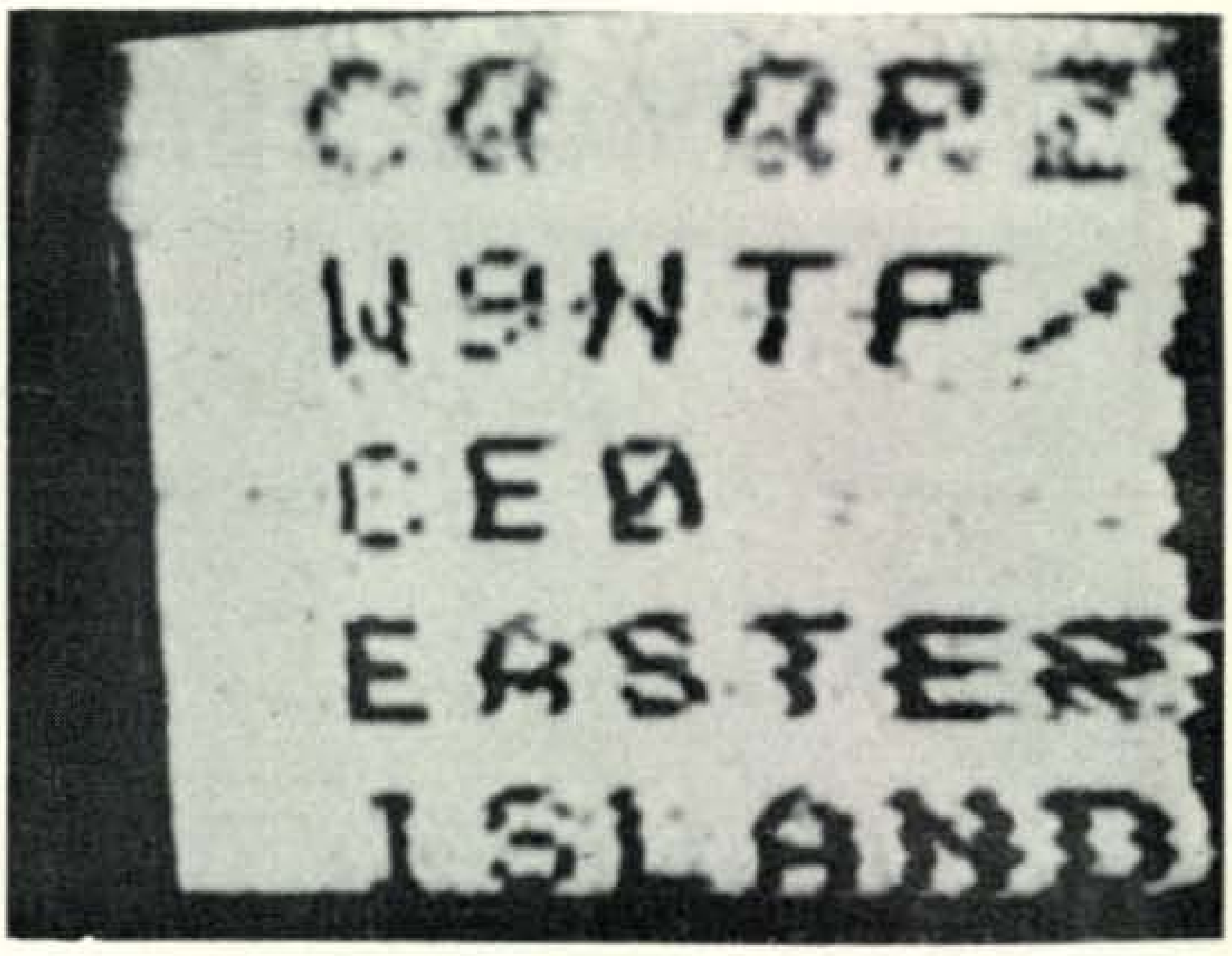
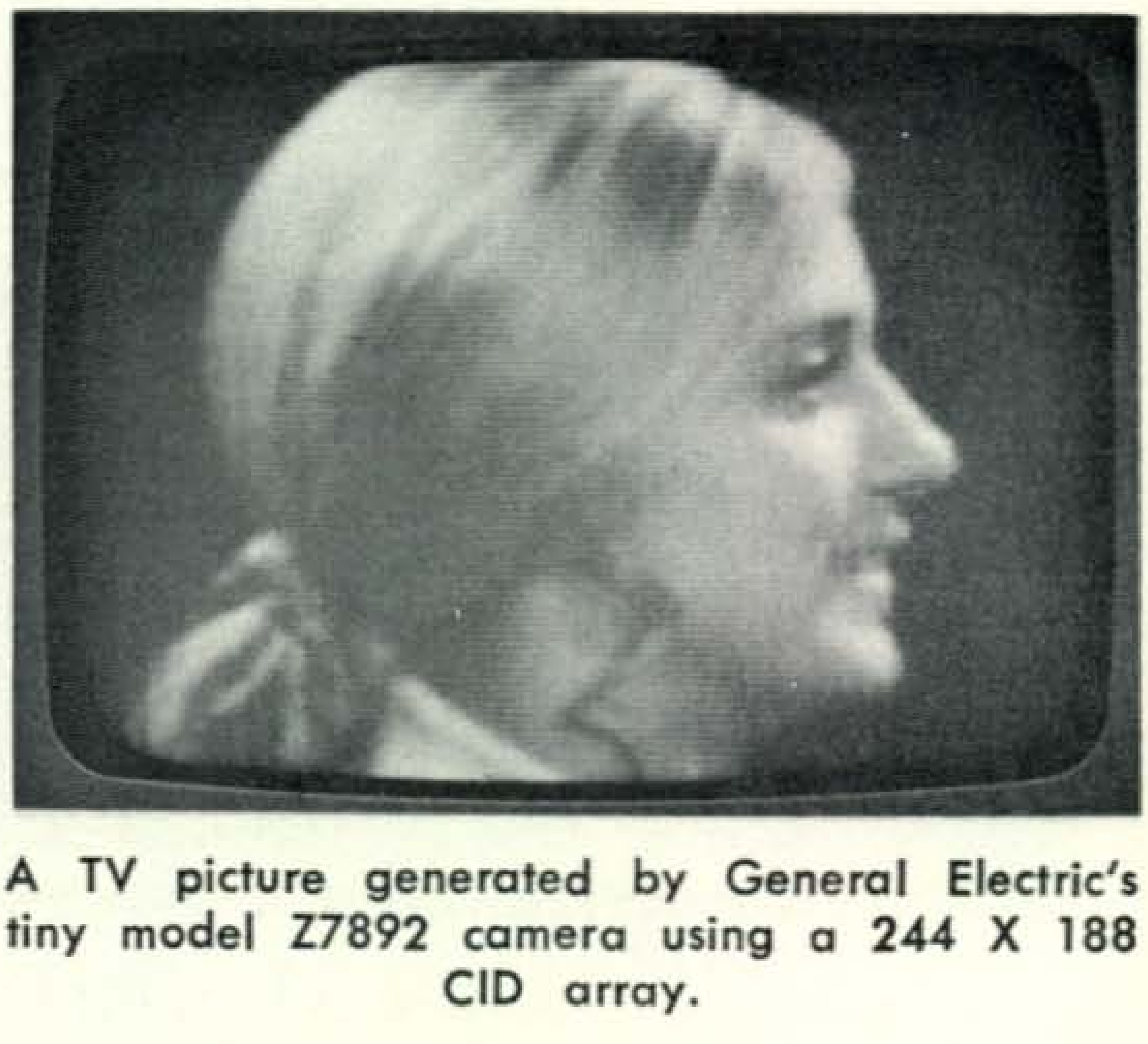


Fig. 3—A combined picture using fig. 1 and 2 with a storage tube converter.

The accompanying photos illustrate both uses of CCD/CID arrays. The picture of the attractive blonde represents the image quality produced by General Electric's tiny TV camera with the un-sexy name, Z7892. It uses GE's 244 (rows) × 188 (elements per row) CID image sensor which provides video information on all unblanked raster lines of a 525-line, 30 frames per second monitor.

Dr. Jim Thomas of Sumner Electronics and Engrg. supplied the photograph of his new combined scan converter and monitor, the HCV-2CS. It uses CCDs for scan conversion. This is a prototype unit, so don't score it for outward appearance!

The main memory of this unit has been designed to use Fairchild CCDs in combination with shift registers to make up a total memory of some 80,000 bits according to the preliminary brochure. The HCV-2CS will take standard CCTV camera or SSTV input for 256 line display on its 9 inch B&W CRT screen. It has provision for "freeze display" which will allow any picture to be "frozen" on the screen. Its fast to slow capability will convert



A TV picture generated by General Electric's tiny model Z7892 camera using a 244 X 188 CID array.

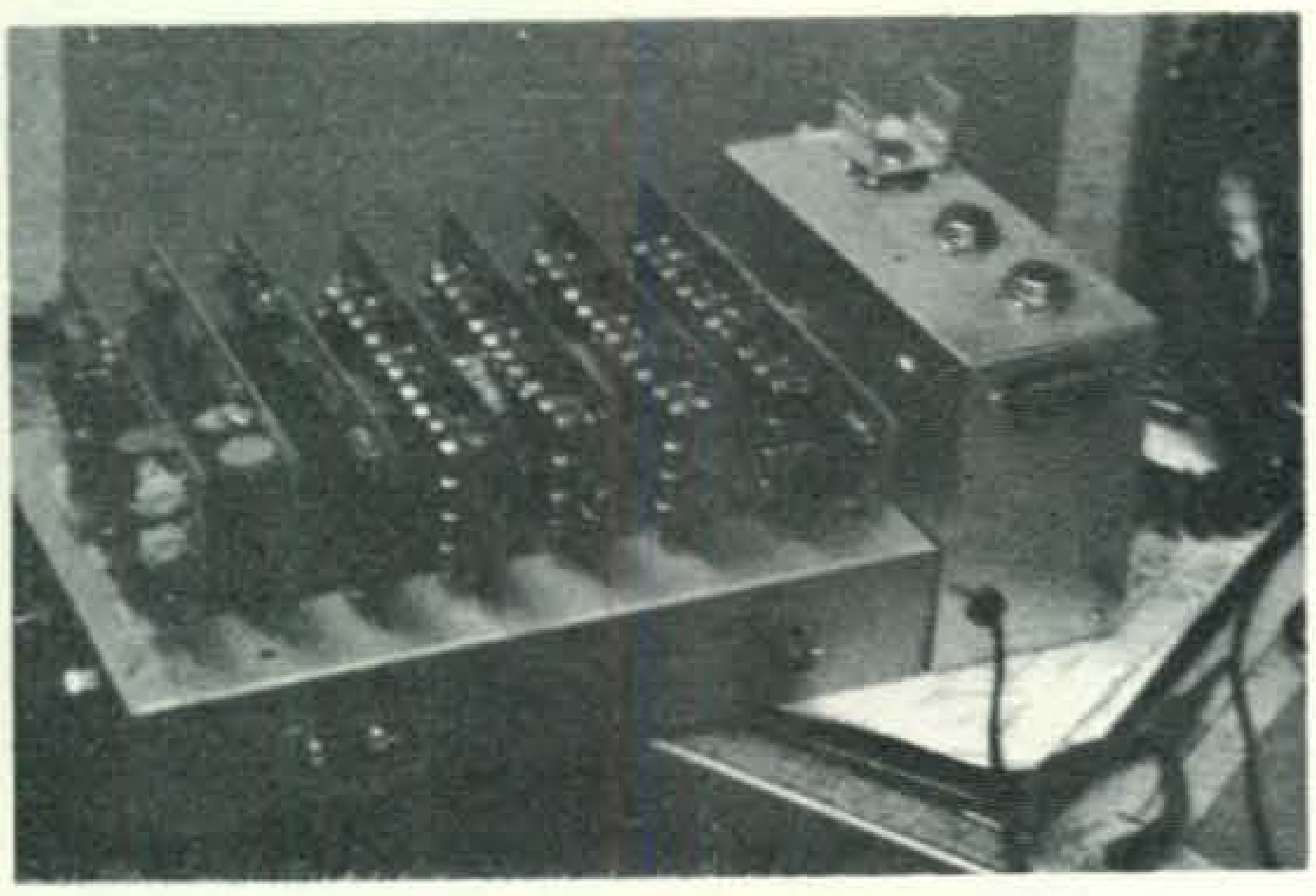
A prototype of Sumner's new HCV-2CS combination scan converter and monitor.

the CCTV camera input to SSTV for transmission. Provision is made for direct fast scan monitoring of the CCTV camera for set up purposes. I expect to receive a prototype HCV-2CS for operational testing sometime soon, so expect to see "off the screen" photos in this column.

So far as I can determine, CCDs and CIDs are still in the expensive and hard-to-get class for the average amateur. However, the prospects for lowered prices on these solid state devices appear to be better than for storage tubes! They are being manufactured by about a dozen firms here in the United States.

For an easy-to-understand, coherent and comprehensive article on CCDs, see "Charge-Coupled Devices" by Gilbert F. Amelio in the February, 1974 issue of *Scientific American Magazine*. Mr. Amelio, who is with the Research and Development section of The Fairchild Camera and Instrument Co. has written what I consider to be the best article I've ever seen on a highly technical subject.

Digital scan conversion is the least costly (and probably most complicated) approach to the problem of fast scan display of SSTV today. How does an SSTV picture get digitized, and after that happens, how does it get UN-digitized so you can see it on a standard TV set?



A digital scan converter built by W2ELF.

In a digital scan converter, the storage tube target or the CCD/CID array are replaced by a bank of ICs that can store data, some IC that can act like a bucket-brigade and feed information into the memory at one rate, and out at another, and a clock plus some switches that make the rest of the ICs do what they're supposed to do at the right time.

One complete frame of SSTV requires storing nominally 65,000 bits of information depending upon how many shades of gray you want to reproduce. This assumes a 128 line picture, each line composed of 128 points, and at least 16 shades of gray.

In operation, the brightness value of each point on each line is converted to a digital form and stored in the memory at slow scan rates. This information is retrieved from the memory in digital form and converted back to an analog voltage to provide a video display at fast scan rates.

Using the design of Dr. Robert Suding, W0LMD, and PC boards made by Phil Howlett, WA9UHV, Walt Bieda, W2ELF built the scan converter shown in the accompanying photo. (See last month's column for an off-the-screen picture from W2ELF.) A number of other U.S. amateurs are building scan converters from Dr. Suding's design. (See the Mar./Apr. 1974 issue of *A-5 Magazine* for a preliminary design article by Dr. Suding.)

Dr. George R. Steber has described an image processing system used in conjunction with a digital scan converter in two outstanding articles appearing in *QST's* March and May issues this year. Look for details on PC boards etc. in this column in a month or two.

News And Pictures From Around The World

Japan: One of the most consistent SSTV signals out of Asia is JA7FS, the station of Ko Sasaki at Akita City. I think the main reason for Ko's big signal on 20 meters is his four element Yagi sitting at 200 feet above ground on a homemade tower! Although Ko is an automobile maintenance engineer by profession, and a tower and antenna designer by choice, he also has great artistic talent. You can see evidence of this in the array of station IDs, CQs, and other SSTV graphics surrounding him in the accompanying photo. Ko, don't get a keyboard! A second picture includes Ko's well-arranged gear on his specially designed desk. A neat lay-out Ko! Space limitations prevent our inclusion of a second complete SSTV operating position and views of his antenna farm—which starts at 75 feet above ground with a six element 15 meter Yagi!

In a recent letter, Ko indicated that interest in SSTV in his country is growing rather rapidly. Incdentally, many JAs are now buying the Tokyo Electron Company's Model

SS727C camera and Model SS727M monitor combination priced at $425 each in Japan.

Australia and New Zealand: John Wilson, VK3LM prefers sending tape cassettes rather than letters. I'm glad that he does, because John packs a lot of information about what's going on "down under" in an hour long cassette!

SSTV activity has increased dramatically in the VK/ZL areas during the past year. John should know, because he is preparing a directory of VK/ZL SSTV and FSTV stations, and he just can't seem to complete it! Have faith, keep smiling, John will have it in print soon, mates.

In addition to his directory project, John is also working on a book which will deal with the construction of several monitors. And, maybe just to keep busy, he and others are producing tapes to be used in the alignment and setting up of monitors. This last item sounds like a nifty idea. Just imagine how helpful it would be to have a handy-dandy tape with a gray scale, rectilinear and circular patterns and a few other goodies available when you're setting up a newly constructed monitor!

During the past few months, many amateurs have purchased the bargain-priced Eumig cameras. These cameras are designed for 60Hz operation and U.S. 525-line, 30 frames per second standards. Conversion to 50Hz operation may present a bit of a challenge to some. If you need help, VK3LM has established full data for this conversion which he will be glad to share. Please observe the courtesy of a self addressed envelope and IRCs.

As is the case in many metro areas around the world, Melbourne has a high level of FSTV activity with about 50 amateurs involved. This compares with under a dozen on SSTV. (Sorry to use non-metric term.) Most SSTV gear is homebrew, and keyboards are pretty scarce in this part of the world. (Even though Doug McArthur, VK3UM (ex VK8-KK) built up one of the first PC boards for this purpose.)

If you're looking for ZL/SSTV action, keep an eye/ear out for ZL2ART, ZL2RR, ZL2-BMQ, ZL2BMI, and ZL2KK. If I mixed up any calls in this list, blame it on VK3LM's Austrylun accent! Sorry John, but I do appreciate the "types in the myle" you've sent me over the years!

In case you have an old call book, P29MC (what a call!) is now VK3CC, and VK9XX is now VK3AQP.

Doug McArthur, mentioned above, had a harrowing and costly experience in the Darwin cyclone. I hope that he will write an article about his experiences and the problems of communication related to the distaster. Doug's financial loss was great. His home was completely ruined. Orchids to Yaesu Musen for their gratis assistance to Doug and other amateurs in getting water damaged gear operational again!

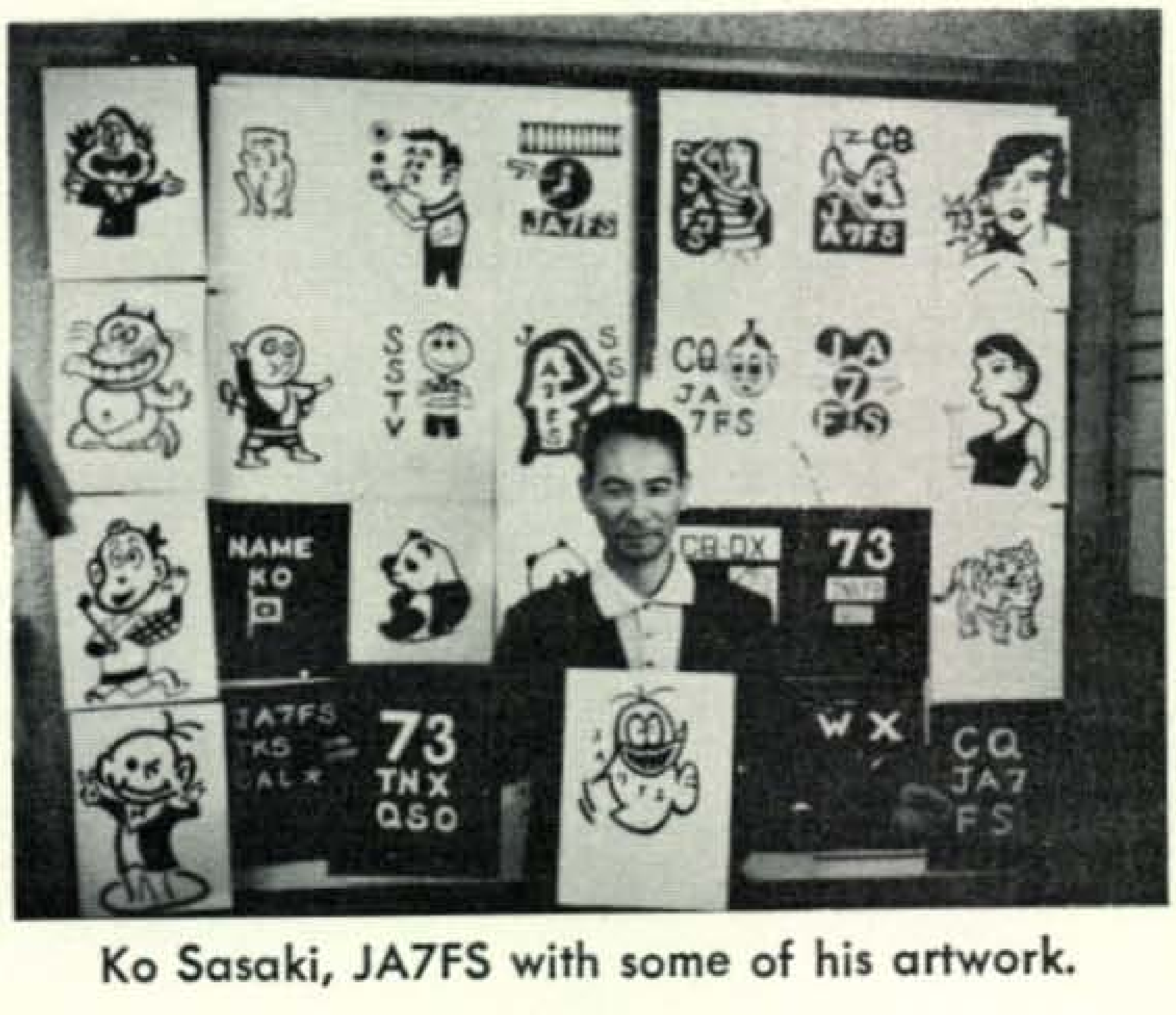
The SSTV station of Ko Sasaki, JA7FS at Akita City, Japan. Ko is shown at the mike.

Things You May Want To Read Dept.

The May 1975 issue of *Scientific American* carred an eight page article on Microcomputers by Andre G. Vacroux. I don't recommend it for light reading while you're watching television, but if you are seriously interested in learning more about these fascinating new tools of the computer trade, don't miss it! It covers just about every aspect of microcomputers you can think of, history, languages, costs, manufacturers, applications, and theory. Congratulations to Mr. Vacroux on his outstanding article!

Intel has a top-notch applications book, *AP-13* published this June. It's titled *Central Processor Designs Using the Intel Series 3000 Computing Elements,* by M. E. Hoff Jr., James Sugg, and Ron Yara. Programmer types will appreciate this book. I'm not sure how freely Intel supplies it, but write to Intel Corporation, 3065 Bowers Ave., Santa Clara, CA. 95051.

[*continued on page 81*]



Ko Sasaki, JA7FS with some of his artwork.

QRPp

LOW-LOW POWER OPERATING

BY ADRIAN WEISS,* K8EEG

A Visit From The Old Man

I had a strange experience a month or so ago and I've done a lot of thinking about it. Some of the details have become fuzzy, but I think I rember the basic drift pretty well. One thing is certain—it made me do some serious thinking, and you know, a lot of what the Old Man said makes sense.

The XYL and kids had turned in after the fireworks and I was sitting out on the porch steps with a pipeful and cold beer, just absorbing the cool evening air and thinking things over. I like to do that when the evening quiet makes for clear thinking. I didn't pay much attention to the slow steps and tapping cane until the Old Man turned into my front walk and approached me. It was hard to make out his features in the moonlight, but he wore a white suit and panama hat and had a white mustache—reminded me of a picture of Mark Twain that I'd seen somewhere. He was the sort of fellow that inspires respect, and when he broke the silence with "Even'in young feller, sure a nice quiet night," I responded in a similar, quiet tone.

"Just passing through town here, and figured that while I was here, I'd drop by chew the rag a bit with you. You're the chap that writes that low power column in *CQ*, aren't you—what do you call it, QRPp?" emphasising the little "p" as if it was something novel and strange to him.

I said I was and shook the thin but firm hand that he offered. I forget his name and call now, but he mentioned them.

"Came across your articles a while back. Reminded me a lot of the good old days when I used to be a radio amateur. Things sure have changed since then and a lot bothers me about the changes. Things you write about low power leads me to believe that the old hamming spirit isn't dead like I figured. That's why I stopped by—just wanted to more or less see for myself if that's so."

I didn't quite catch his drift, and when I explained that the QRPp trend was a new thing in amateur radio and that it was making hamming a great experience for quite a few hams, he continued in the same soft voice.

"That's just it, young feller, there's nothing new about doing it with low power and getting great satisfaction. Nothing new at all. That challenge and adventure and satisfaction that you write about is what made ham radio what it was in the good old days."

He leaned back, pulled out a corncob, and while he filled it from an old leather pouch, crickets filled the quiet night air with their chatter. I got a better look at him in the flickering light of the match with which he lit up. There were a few smooth wrinkles, but his face had a sad, far-away look about it. He puffed the corncob to an orange glow, and then went on.

"You haven't been around long enough to remember what it was like back then. Probably never even seen a spark-gap"—I nodded affirmatively—"Back then, I mean when tubes first came in and CW transmitters and regens opened up whole new worlds to the ham, technology and knowledge were in an infant state. All we had were '10's, 199's, and 201-A' for tubes. You really had to sock the voltage to 'em to get ten watts out. We didn't have quads and yagis either—they were just ideas waiting to be born. You fellers work DX on 15 meters and are proud of it—heck, we didn't even know that radio waves propagated on wavelengths that short! First it was 200 meters, then 150, then 80, and then on down. That's where we worked our DX."

He looked up at the moon through the branches of that tree out in the front yard and pulled a few times on the corncob. I didn't have the slightest idea of what a 201-A was, or that you could work anything on 200 meters, but I acted like I was right with him.

"The point is, young feller, with the technology and knowledge that existed then, ham radio boiled down to one basic factor—the man at the key. He was *the* important factor in every new contact, in every new step into the unknown territory below 200 meters. He didn't know whether his signal would get out of the back yard on 80 meters, but he sat at the rig night after night, listening and calling long and hard until someone came back to him. Before you knew, a whole bunch follow him down there and joined the effort to discover what was possible. That's the spirit of the thing that I'm talking about."

I sat there trying to imagine what it was like to ham in those days. That they were using low power and making contacts with it didn't really impress me that much. I've been doing the same for years. I guess what really got me was the business of daring to open up new parts of the frequency spectrum that perhaps the experts said were useless. And I could really feel at home with what he was saying about the man at the key.

"By gosh, when I open up a ham magazine these days—something I rarely do because of what I find there—I ask myself: Is this what we all had in mind when we reached out into the unknown. Where is all the courage we depended on? Where is the individual effort now? Why, I look at the pictures of these fancy so-called shacks and see nothing but shiny gadgets and transceivers. Then I find out that the fellers have to send 'em back to the factory when something goes wrong. There's something wrong if that's the case. We built our own, and we had to fix it if something went wrong. And what about all these gadgets that keep pushing the man at the key further out of the picture? Programmed keyers that automatically send out a selected message, contesters that do everything down to writing the log on a computer printout sheet. Is that all that ham radio is these days?"

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*213 Forest Ave., Vermillion, SD 57069

I mentioned that these things are all advancements in communications technology and essential to the progress of the hobby.

"Hogwash," he replied with a growing agitation in his voice, "What kind of progress is it that moves the human being who is supposed to be communicating right out of the picture? Where's the communication? Hell's bells, where does it all lead to? Think of it. Before you know it, there won't be any hams anymore, just a bunch of technicians who turn on a fully automated station and turn it loose to make 1400 contacts per hour exchanging programmed information with other fully automated stations and printing it all out on the log sheet! No sir, somehow all this progress seems to be leading amateur radio further away from what it used to be in the early days. It just doesn't seem very 'amateur' anymore, judging from what I see in the magazines."

I was beginning to get an idea of what he was driving at. But I went ahead and noted that as technology and knowledge of radio communications advances, so must the ham. The modern ham couldn't be expected to use the equipment of the 'thirties when the world has moved along.

"Now, don't get me wrong. Didn't mean to imply any such thing. Far from it. But it looks to me the world has moved along and left behind your typical amateur if he can't even fix his own gear. What good has been achieved by your progress in knowledge and technology if a guy has to send the rig back to the factory first time anything goes wrong with it? It sure seems to me that either the world ought to get backward or the ham forward in such a case. That's what I'm talking about. Now, you take some of those things you write about in your articles. Fr'instance, that the QRP-p man offsets his power disadvantage through skill and his knowledge of propagation and such things. Now that's what I call the same spirit as we had in the old days. Only difference is that we had no choice in the matter of how much power we were running. It was take it or leave it. But you look at the situation today. Any wonder why a situation exists where a man has to know only next to nothing to get on the air and make contacts. A man has only to plunk down a couple hundred dollars, hook up an antenna, which he also plunked down for, and he's pumping more r.f. into the ether than we ever dreamed of—or cared about for that matter. Why, if you want my opinion, the F.C.C. ought to require every ham to demonstrate his ability to build the piece of gear that gets him on the air. You look at the Novices today. Was a good idea when they started that class back in the '50's. If I recall rightly, most of them built their rigs from scratch, or at least from a kit. But that's all past. From the looks of it, seems like the new Novice is going to be able to run 250 watts, which will mean the end of any real need on his part to learn something about skills and what makes a radio wave go from one place to another."

We talked on long into the night before he tapped his corncob gently on the step and stood up kind of slowly, as if it were a real effort. I suppose it was. He said that he'd better be getting along as it was too late for an old man such as himself to be out galavanting around. I remember quite clearly his parting words. He said something that made me feel that somehow despite the years separating us were looking at the world through the same pair of glasses. After shaking my hand, he spoke in a voice that somehow sounded like it was coming across many years: "You QRPp fellers, you keep at it. You're onto the real thing and you won't lose sight of it as long as you remember the most important thing—the man at the key. Let the rest of 'em depend on KW's—you stick to your guns and make the man at the key count most." With that, he turned down the walk and slowly disappeared into the darkness. Whenever things are quiet and I'm out on the steps thinking about ham radio, every now and then I fancy that I hear those slow steps with the tapping of the cane. I haven't seen him since, and probably won't again. But as I remember other things that we talked about, I'll pass them along. 73, Ade, K8EEG/0

Spread The Word

An eye-catching bumper sticker encouraging the man in the street to "Talk to the World—Become A Ham Operator" is available from *CQ* for 25¢ plus a legal-size s.a.s.e. Quantity prices upon request. Write to: *CQ*, 14 Vanderventer Av., Port Washington, NY 11050.

NOVICE SHACK

BY HERBERT S. BRIER,* W9EGQ

Getting The Most Out of The 21 And 28 MHz Novice Bands

Historically, as the sun moves each fall to spend the winter in the southern hemisphere, our days get shorter and our nights get longer. At the same time daytime maximum usable frequencies (MUF's) for long-distance *ionospheric* radio communications increase from the summer values, and the night-time MUF's decrease. Until recently, no one really knew why daytime *ionization* of the highest (F2) layer of the *ionosphere,* which reflects or refracts high-frequency radio signals back to the earth, is highest in the winter. The present theory, which is supported by a number of satellite observations, is that prolonged solar bombardment of the *exopore* in the summer in either hemisphere releases free electrons thaat migrate via the earth's geomagnetic field to concentrate in an electrified layer above the winter half of the earth. The lower layers of the *ionosphere* are not affected by the geomagnetic field. Thanks to David D. Miesel, Department of Physics and Astronomoy, "State University College of Arts and Science," Geneseo, N.Y., president of the American Meteor Society, for this information.

After inflicting that glob of *ionospheric* theory on you, we wish we could assure you that DX will be plentiful and easy to work on the 21 and 28 MHz Novice bands from now until next spring. Unfortunately, the recurring 11-year sunspot cycle is now at its lowest value in years, and the experts predict that it will be at least a year before the sunspots increase significantly. When sunspot numbers are high, *ionization* levels are also high, and strong DX signals roll in on 21 and 28 MHz day after day from early fall until late spring. When sunspots are low, however, good 21 and 28 MHz band openings lasting for an hour or two often come and go without many operators being aware of them. One reason for this is that too many operators tune their receivers across an apparently "dead" band once or twice and, hearing nothing, flip to another band. However, if operators would both listen and call a number of "CQ's," operators hundreds and thousands of miles apart will have maximum opportunities to take advantage of any band opening. Ten and 15-meter amateurs can learn something from CB operators in this area. They take advantage of every illegal (for them) opening, because many of them are always listening and transmitting.

George Jacob, W3ASK's, monthly PROPAGATION column in *CQ* is a powerful tool for spotting openings. Consult George's charts for the times that various paths are most likely to be open. Then, consult his "Last Minute Forecast" box (sometimes in the previous month) for his predictions of the days that conditions will be "Above Normal" or "High Normal" and concentrate your efforts around them. As an example, nothing particularly exciting was predicted on 28 MHz for last October, but George's last minute forecast predicted "Above Normal" conditions for October 6, 8-9, and 11. From October 6 to 14, 10 meter conditions all over the world were superb—the best that they had been in years. George does not "hit the jackpot" like that every time; however, his accuracy is 90 per cent. His "Below Normal" predictions can save you time, also.

The National Bureau of Standards station WWV on 2.5, 5, 10, 15, 20, and 25 MHz is another useful tool for getting maximum use out of the 21 and 28 MHz bands. At 14 and 18 minutes after each hour, it transmits propagation data: the 14-minute-after-the-hour transmission is revised every six hours. It goes something like this: "The radio propagaton quality report for 0100, 0700, 1300, or 1900 Coordinated Universal Time (formerly called GMT) is *useless, very poor, poor, poor to fair, fair, fair to good, good, very good, or excellent.* Current geomagnetic activity (K) is *very quiet,* to *extremely disturbed.*" The coded

Bob Fields, WN6WUW, Box 884, El Sobrante, CA. 94803, really turned his station up-side down looking for contacts. He works 40 and 80 meters and has logged 33 states, Mexico, and several Canadian call areas. The transmitter looks like a Heathkit "Apache", and the receiver is a Hammarlund.

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*409 South 14th St., Chesterton, Indiana 46304 forecast is *November* (N), *Unifrom* (U), or *Whiskey* (W) followed by a number 1 to 9, although less than 3 or more than 7 is extremely rare. The K index at 000, 0600, 1200, or 1800 coordinated universal time is followed by a number from 0 to 9. The 2800 MHz solar flux index is followed by a number and a short descriptive phrase like "increasing or decreasing slowly." The 18-minute-after-the-hour transmission gives similar information in a somewhat different form.

Interpreting all the WWV propagation data properly will make you your own propagation forecaster. Until you reach that goal, however, look for *N5* or better, *K2* or less, and solar flux numbers of *90* or better and increasing. The solar flux index is roughly equivalent to an instantaneous sunspot report. The higher either is, the more likely that 10 and 15 meter conditions will be good. Look for CE0AE, Easter Island, on the 15th and 30th of the month especially when W3ASK's and WWV's crystal balls predict great things to come.

ARRL License Manual on Tape

Tell your blind friends who are interested in amateur radio that the ARRL *Radio Amateur's License Manual* on 15/16 inch-per-second tape cassettes are available from the regional libraries of the Library of Congress. Its number is CBA-4058. Also available is the *Radio Amateur's Operating Manual*. Its number is RC-7821. Both tapes were recorded by ARRL Vice President Vic Clark, W4KFC.

Grounding Your Equipment For Safety

In a recent contact, an operator said he saw a spark when he connected a ground wire to his new transceiver, even when its switch was off, should he omit the ground? His problem was that he plugged the power cord into the wall receptacle before the other connections were made, and the ground lead was reducing the voltage coupled to the transceiver chassis from the power line through the line bypass capacitors to zero. Without an external ground connection, when the operator touches the metal cabinet of most transmitting equipment and a grounded object simultaneously, the discharge currents flow through his body. Usually the result is a mild shock. If the bypass capacitors are large or there is an accidental short between the "hot" side of the power line and the metal chassis, the shock can be painful or even fatal for a youngster or someone with heart trouble.

If your house is equipped with 3-prong grounded electrical receptacles, by replacing the equipment 2-conductor power cord with a 3-conductor cord and plug and connecting the third "ground" conductor to the equipment chassis/cabinet, the latter will always be safely grounded. An actual short between the power line and the metal cabinet will signal something drastically wrong by blowing the line fuse or popping the circuit breaker rather than by electrocuting an amateur. Note that this ground is not intended to replace any other ground connections required for the efficient operation of your equipment or antenna. It is designed to save your life.

Raymond Hague, WN0CBN, 4529 N.E. 38th St., Des Moines, Iowa 50317, had worked 32 states and four countries when this picture was snapped. A 400' "long wire," a Hy-Gain 14-AVQ vertical and a home-brew 15-meter beam gets the signals from his Hallicrafters HT-32 and Heathkit DX-60 transmitters where they want to go. A Hallicrafters SX-101 receiver completes the station. We are sending Ray a 1-year subscription for CQ for this winning entry in our Monthly Novice Shack Photo Contest. We invite you to try your luck. Send a sharp photo (preferably black and white) of you and your station and some information about your radio career to: Novice Shack Photo Contest, c/o Herbert S. Brier, W9EGQ, 409 South 14th St., Chesterton, Ind. 46304.

News And Views

Frank Pirratino, WN3YSP, 302 E. Drinker St., Dunmore, Pa. 18512. went from Novice ticket to General in seven months. Along the way, he worked 31 states on 80 and 40 meters using the Heathkit DX-60 transmitter and HR-10 receiver and HG-10B v.f.o. His antenna is a "long wire" matched to the inside equipment through a home-brew "transmatch" and a home-brew s.w.r. bridge for which he won a prize at the Abington Amateur Radio Club. Not too bad for a youngster that got interested in Amateur Radio at the age of 66. Ron WA3WBC, gave us this information on Frank. He also sent a picture for our Photo contest, but it just was not sharp enough to reproduce . . . **Thomas R. Sundstrom,** WN2-

[*continued on page 81*]

DX

BY JOHN A. ATTAWAY, *K4IIF

The WAZ Program

Single Band WAZ

80 Meter Phone

1	EA8CR

20 Meter Phone

12	KA6DE	13	EA8CR

S.S.B. WAZ

1268	SM6EQS	1272	WA7RFH
1269	UN1CC	1273	VE6FFA
1270	W3IF	1274	JE1BSD
1271	K9PQG	1275	DK8SK

C.W.—Phone WAZ

3851	W5FGO	3856	DK6FT
3852	F3IM	3857	DJ7IT
3853	4X4NJ	3858	DK2QF
3854	JR3BHW	3859	DL9CJ
3855	YU4JHI		

Complete rules for the Single Band WAZ Program appear on pgs. 57-58 of the December, 1972 issue of *CQ*. Complete rules for regular WAZ are found beginning on pg. 46 of the April, 1975 issue. Application blanks and reprints of the rules for all WAZ awards may be obtained by sending a self-addressed, stamped envelope to the DX Editor, P.O. Box 205, Winter Haven, FL 33880.

As announced in last month's column, Jerry Hagen, WA6GLD, has resigned from the post of DX Editor due to the press of important job and family committments, and John Attaway, K4IIF, has become DX editor for a second term. Speaking for the staff, we have enjoyed working with Jerry over the past 5½ years, during which he progressed from WPX Manager to Assistant DX Editor to DX Editor, and we wish him well in his future endeavors.

We are very pleased to announce that Hugh Cassidy, WA6AUD, will succeed Jerry as Manager of WPX and the CQ DX Awards and will also serve as the new Assistant DX Editor. Hugh has been Editor and Publisher of the West Coast DX Bulletin since it was founded 7 years ago, and he is one of the world's foremost DX reporters. We feel very fortunate to have him on the staff. His first DX column will appear in the October issue.

80 Meter—No. 1

Two major firsts have been scored in the Single Band WAZ Program by Dr. Fernando-Juan Fernandez, EA8CR, of Santa Cruz de Tenerife, Canary Islands. On June 24, 1975, 80 Meter Phone WAZ #1 was authorized to Fernando-Juan, followed on June 28, 1975 by 20 Meter Phone WAZ #13, making EA8CR the first station to qualify for Single Band WAZ on 2 separate bands.

Fernando-Juan's 80 meter phone WAZ is a monumental achievement. In staff discussions at *CQ* it had been predicted that the plaque for 80 meter phone would be one of the last to be awarded. Both the staff and most members of the *CQ* DX Awards Advisory Committee felt that 40 meter c.w. and phone would follow the 20 meter awards because of the effect of poor band conditions on 15 and 10 meters, but that 15 would produce a winner ahead of 80 meters. It was felt that when the 80 meter

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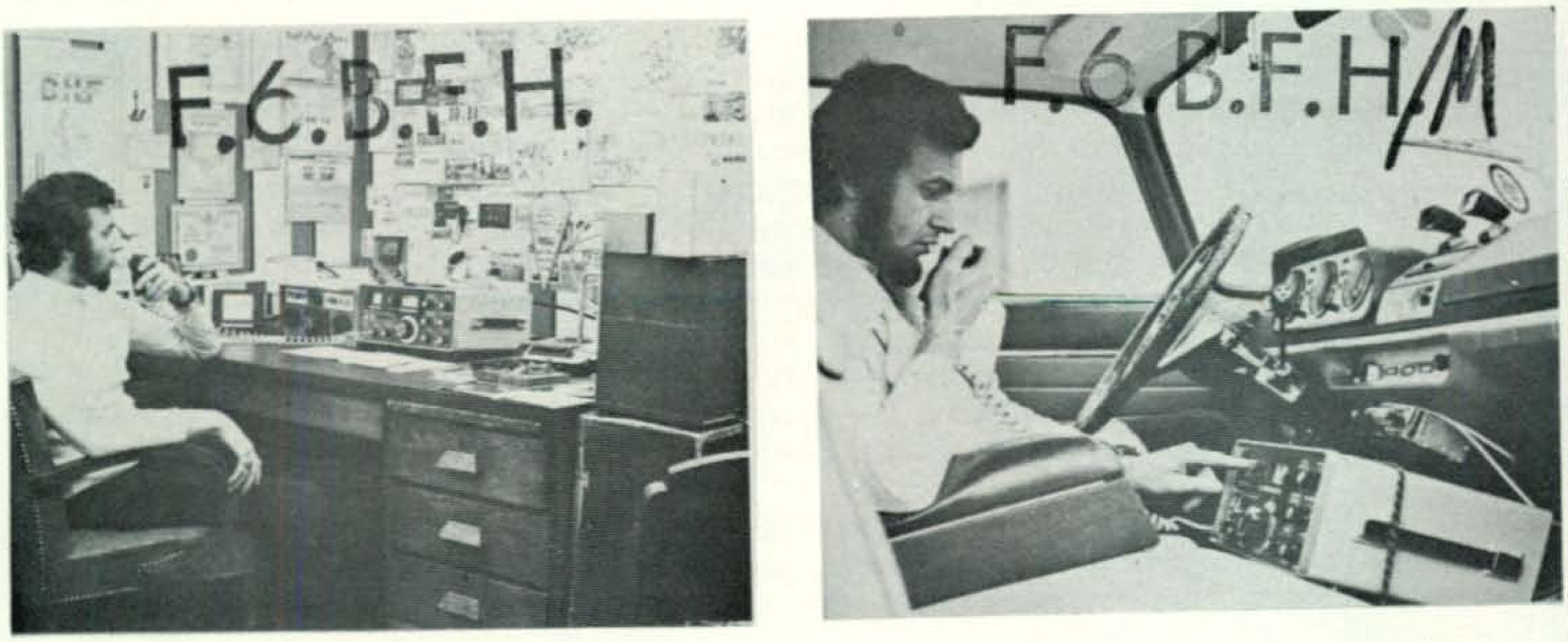
*P.O. Box 205, Winter Haven, FL 33880



Alain Duchauchoy, F6BFH, of Bihorel, France is an enthusiastic DXer both at home and on the road. Above, left, is the gear at his base station and on the right is the mobile equipment in his Peugeot 406. Alain is a recent WAZ winner.

The WPX Program
Mixed

489......UK4WAC
490......UA3FT
491......UK3SAB

C.W.

1398......WB2CST
1399......UA6AJG
1400......UY5CQ
1401......UK4YAB
1402......UB5BAZ
1403......UP2NC
1404......UK9SAA
1405......UA4LK
1406......UA3GP

2 × SSB

857......G4CVZ
858......I6CCI
859......UK4WAC
860......UD6BR

VPX

89......DL-13911
90......UA3-142-130

Endorsements

Mixed: WB2FMK, YU1BCD-150, WA2EAH-900, UA3FT-750, UC2BF-700, K2MFY-600, WA2AUB, W0YVA/4-550, K9HLW, K9UQN, K2HWF, WA9UEK-500
C.W.: DL1QT-1000, WB2FMK-950, YU1BCD-900, W3ARK-850, YU1SF-800, UB5WK, VO1KE, VE1MF-650, OK2BLG-550, K2MFY, W9EVD, WA1JMP, WA3CSF-500, HP1AC-450, K9HLW-400
2×S.S.B. I4ZSQ-900, YU1BCD-800, W2EHB, W6TTS-700, UC2BF-650, WB2FMK, ZL1AGO-600, UD6BR, WA1JMP-500, I6CCI-450
40 Meters: K8MFO, OK2BLG
20 Meters: UK4WAC, G4CVZ
15 Meters: W6KYA, W4ZYQ
Africa: DL-13521
Europe: WA2AUB, UK4WAC, G4CVZ, UA4LK, UA1AP
North America: WA7OBH, WA2AUB, K2OLG
South America: UC2BF

Complete rules for WPX may be found on page 67 of the February 1972 issue of *CQ*. Application forms and reprints of the rules may be obtained by sending a business size, self-addressed stamped envelope to Mr. Hugh Cassidy, W6AUD, Assistant DX Editor, 77 Coleman Drive, San Rafael, Calif. 94901.

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barrier was broken, it would be on c.w. rather than on phone. Our sincerest congratulations to EA8CR.

Among Fernando-Juan's other DX and Contest achievements are 5-band DXCC, the 40 meter championship in the 1974 *CQ* Worldwide Phone Contest (Continental record holder), the first place and world record holder in the WAE DX Contest in 1974, a 1967 high in the WAE contest plus second place finishes in 1965 and 1973, and the 1958 championship in the EA-CT contest. He is also just a few QSLs away from Single Band WAZ on 40 and 15 meter phone so if you're working for #1 on those bands you had better move.

The rig at EA8CR includes the Collins S-line, Drake TR-4C plus L-4B, Signal One CX-7 and Alfa 77 to a TH6DXX, a 2-element 40 meter beam and 2, 80 meter dipoles oriented in different directions.

Dr. Fernandez has an M.D. degree and is Professor of Neurology in the Medical School of the University of the Canary Islands.

Here and There In the World of DX

New England DXCC will hold its annual meeting and banquet on Oct. 4, 1975 at the Holiday Inn of Waltham, Massachusetts. Further information may be obtained by sending a self-addressed, stamped envelope to Tony Berg, W1VAH, 1 Vanderbelt Road, Acton, MA 01720.

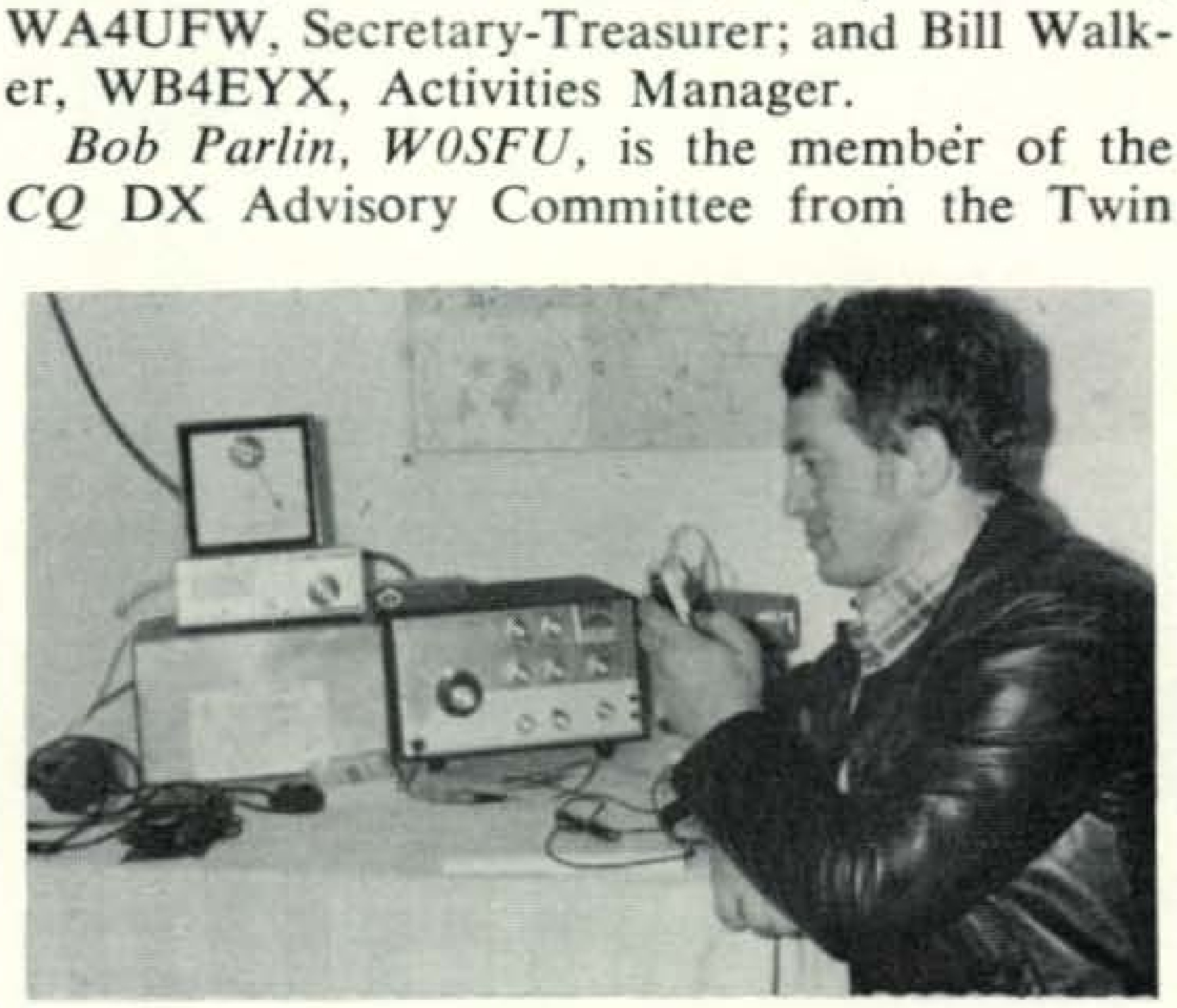
Dr. Fernando-Juan Fernandez, EA8CR, who recently qualified for the first Single Band WAZ award on 80 meters. He is also the world's first DXer to earn Single Band WAZ on 2 separate bands.

Loyd, W6KG, and Iris, W6DOD, Colvin are able and eager for a major new DXpedition if a suitably rare country, preferably an entirely new one, can be scheduled. Ideas anyone? Is so, contact Loyd and Iris at 5200 Panama Ave., Richmond, CA 94804.

Western Washington DX Club officers are Rod Linkous, W7YBX, President; Stu Hoar, VE7ZZ/W7, Vice President; John Gohndrone, W9INH/W7, Secretary; and Dick Hendrickson, K7CVL, Treasurer.

North Florida DX Association officers are George Werner, W4ORT, President; Ron Blake, WA4EYR, Vice President; Billy Williams, WA4UFW, Secretary-Treasurer; and Bill Walker, WB4EYX, Activities Manager.

Bob Parlin, W0SFU, is the member of the *CQ* DX Advisory Committee from the Twin



Interest in WAZ has been running high among Yugoslavian amateurs, with 1 or more winners from YU-land each month. Ratko Novakovic, YU1OBA, recently qualified for the c.w.-phone award number 3776.

CQ DX AWARD HONOR ROLL

The *CQ* DX Award Honor Roll recognizes those DXers who have submitted proof of confirmation with 275 or more countries for the mode indicated. The ARRL DXCC Country List, LESS DELETED COUNTRIES, is used as the country standard. The total number of current countries on the DXCC list as of this listing is 321.

C.W.

W6PT	320	W8LY	310	ON4QX	304	W4BQY	299	K1SHN	289
K6EC	316	W4IC	309	W0AUB	304	DL3RK	298	WA6EPQ	288
W6ID	316	W6ISQ	305	K6LEB	302	W6NJU	294	WA8DXA	287
W8KPL	314	W9DWQ	305	YK3AHQ	301	WA6MWG	293	DJ7CX	281
W4YWX	312								

2 × SSB

TI2HP	320	VE3MR	314	WA6MWG	309	K6AQV	299	DJ7CX	287
W2TP	320	W6EL	314	W9KRU	308	HP1JC	298	K1KNQ	287
W2RGV	319	W6KTE	314	VE3GMT	307	W0YDB	298	SP5BSV	287
DL9OH	318	W9DWQ	314	K3GKU	307	K4HJE	297	DL1MD	286
G3FKM	318	W9JT	314	K3EC	307	W6FW	297	OE3WWB	286
I0AMU	318	F9RM	313	F9MS	306	DK2BI	296	W6TCQ	286
WA2RAU	318	WA2EOQ	313	WA3IKK	306	YV1KZ	296	K8GQG	286
W3NKM	318	W2QK	313	W9QLD	306	G3RWQ	295	W3CRE	284
W9ILW	318	W6RKP	313	XE1AE	306	W9OHH	295	DK1FW	282
K2FL	317	K6WR	313	OE2EGL	305	YS1O	295	OK1MP	282
W4NJF	317	W6YMV	313	OZ3SK	305	K1SHN	294	VA7WJ	282
W4EEE	316	K4MQG	312	K9WEH	305	W8ZOK	293	WB6PNB	282
W4SSU	316	F2MO	311	ZL1AGO	305	WA0CPX	293	K8PYD	282
SM5SB	315	I0ZV	311	VE2WY	304	DL6KG	292	WA2VEG	280
W3AZD	315	I8YRK	310	W2CNQ	304	W0SFU	291	W6HUR	279
W4IC	315	W6NJU	310	G3DO	303	G3KYF	290	W9YRA	277
W6EUF	315	ZL3NS	310	WA6AHF	303	OE1FF	290	I1WT	275
W6REH	315	ZS6LW	310	W6KZS	303	WB2RLK	290	VE7HP	275
I8AA	314	SM6CWK	309	VE3MJ	302	W6FET	290	K6GUY	274
I8KDA	314	K4RTA	309	WA2HSX	301	XE2YP	289	W4WSF	274
IT9JT	314	KH6BB	309	WB6DXU	300	YV1LA	289	K9LUI	271
SM6CKS	314	W3DJZ	309	K8DYZ	300	WA0KDI	288	G3WW	271

City DX Association, replacing Bill Higgins, W0YDB, who did a fine job for so many years. W0SFU will be remembered by *CQ* readers as winner of the plaque for Single Band WAZ No. 1 on 20 meter phone.

The Radio Amateur Club of Guatemala will conduct a special operation Sept. 13, 14 and 15, 1975 in celebration of the independence of Guatemala. The operation will be headquartered in the 2500 year old jungle temples at Tikal, ancient capital of the Mayan Empire, using the callsign T75AA. Frequencies to be used are 28600, 21300, 14195, 7080 and 3780 ± 5 kHz. Special QSLs and certificates are planned.

Al Friedman, W9YRA (ex-K6YRA), is one of the latest to qualify for the prestigious single-band WAZ certificate. In the 3 years since moving to 9-land, Al has confirmed 285 countries and rejoined the CQ S.S.B. Honor Roll where he was tops as K6YRA. He is the 9th in the world to work all 40 zones on 20 meter phone since the single-band awards were initiated.

Delta DX Association officers are Cliff Ryan, WA5WEY, President; Frank Sicuro, W5KKZ, Vice President; Russ Guidry, K5YMY, Secretary; and John Meyer, W5JFB, Treasurer; while at the *San Diego DX Club* the following are now "running the show:" Al Olsen, K6PO, President; Glenn Means, W6AQ, Vice President; and John Bender, W6ABT, Secretary. Since our last listing of *Northern California DX Club* officers there has been a new slate elected: Bill Johnson, W6MUR, President; Orman Meyer, K6QX, Vice President; Dave Palmer, W6PHF, Secretary and Howard Hale, W6SC, Treasurer.

160 Meter News

An interesting compilation of distance records on top band has been assembled by Earl W. Cunningham, W5RTQ, of Houston, Texas, who is evaluating the possibility of Trophies for participants in record distance QSO's on 160.

Earl's data shows that the longest distances on 160 have been between stations in the British Isles and stations in New Zealand, with the margin varying according to the exact locations in the two island groups. The greatest distance now documented is a 1955 contact between G6GM and ZL3RQ, 11,939.9 miles or 19,215.3 kilometers. This is closely followed by a number of other stations in the U.K. or Ireland who have worked ZL3RB on 160 and two others who have worked ZL3RQ. This group includes the following in order of greatest distance, with the mileage shown in parentheses: G3ZYY (11,927), G3PU (11,882), G3CFV (11,864), G6CJ (11,852), G3SED (11,838), G3SZA (11,837), G30LI (11,827), G5WP (11,804), G3SVD (11,798), G3RBP (11,791), G3UQD (11,781), G3RFS (11,,767), G30QT (11,762), EI9J (11,761), G3RPD (11,760), G3PQA (11,760), G3FGT (11,758), G3ERN (11,752) and GD4BEG (11,669).

The call listed most frequently in Cunningham's records is ZL3RB who has participated in at least 21 documented QSO's of over 11,000 miles on 160. Doubtless he has made many others.

The longest distance QSO's after the New Zealand to Great Britain listings have taken place between Brazil and Japan, with the record held by JA5DQH and PY2FUS, 11,719 miles. JA2GJO has also worked PY2FUS and the following stations in Japan have worked Brazilian station PY1RO who rivals ZL3RB: JA5DQH, JA5EZI, JA3AA, JA3PNP, JA3-ONB, JA2GQO, JA6WGE, JA2UEO, JA1-MCU, JA0SX, JA7AO, and JA7NI.

The greatest distances involving North American amateurs include VK6HD—W1HGT (11,616 miles) VK6HD—W1BB/1 (11,612), VK6HD—KV4FZ (11,446) and VK6HD—W5RTQ (10,584). The longest north-south contact on record is between KL7HEE and a VP8 station in Halley Bay, Antarctica (10,955 miles).

Although it is possible that some QSO's followed a long path, no attempt could be made to establish a record other than over the shortest possible distance between the 2 points in question. Any reader with a long distance contact on 160 who would like to be listed in the records should contact W5RTQ. As we approach the sunspot minimum activity on 160 by DXers should increase and the possibility of new records is very real.

Rare Prefix News

C7A—C7Z—This prefix block has been allocated to the World Meteorological Organization.

CG3—CG3GCO on 20 meters was VE3GCO using the special Canadian prefix.

HU1—This is an El Salvador prefix. QSL HU1GMV to YS1GMV.

IBO—IB0JN on Ventotere Island was Joe, I8JN, who will be active weekends on 10, 15 and 20 mters.

IMO—IM0BVS was operated by 12BVS from Maddalena Island.

KC1—KC1CRD, April 12-16, 1975, commemorated the 200th anniversary of the battle of Concord. QSL to W1GVN, 500 Lexington Rd., Concord, MA 01742.

At a recent press conference, Jack Troster, W6ISQ, (above) of the Northern California DX Club, announced a new "California Bi-Centennial Award" for 1976. According to press releases distributed by club secretary Howard Hale, W6SC, this award will only be available to licensed amateurs outside the contiguous 48 states. It will require proof of contact with 76 California stations plus 13 contacts with Northern California DX Club member stations. W6UZX will be the award manager. *(Tnx WA6GLD.)*

KH4—KH4ITU should be QSLed via Ken McGee, K0CMF/4, 11812 Breton Ct., #212, Reston, VA 22091.

LB3—LB3P on 20 meter c.w., heard about 1940—2000 GMT, was a special Norwegian operation.

PA7—During 1975, amateurs in the city of Amsterdam are using the PA7 prefix in place of PA0 to celebrate the 700th anniversary of the city.

PI1—PI1RRS on 80, 40 and 20 meters, July 1, 1975, celebrated the 62nd anniversary of the Royal Dutch Air Force.

WH8—From May 13-18, 1975, WH8TT operated from the Holland Tulip Festival in Holland, Michigan, largest tulip festival in the U.S. QSL to K8DAA.

[*Continued on page 80*]

The CQ DX Award Program

C.W.

180......DL6GN

2XSSB

402......DK7NL
403......DJ9RB
404......SP9EES
405......I1DWH
406......WB5HVY

Endorsements

CW: DL6GN—150 Countries, W3IN-1.8 MHz
2XSSB: DJ9RB—150 Countries

Complete rules and application forms for the *CQ* DX Award program may be obtained by sending a business size, self-addressed stamped envelope to Mr. Hugh Cassidy, WA6AUD, Asst. DX Editor, 77 Coleman Drive, San Rafael, Calif. 94901.

Propagation

BY GEORGE JACOBS,* W3ASK

MID-September to mid-October is generally a period of changing propagation conditions on the h.f. amateur bands. On some days, conditions should continue to be much the same as they were earlier in the summer, but on other days the first signs of wintertime conditions should be noticeable. This month's *DX Propagation Charts* cover the period of variable conditions between September 15 and October 15, rather than the usual two month span. A *Short-Skip Propagation Chart* for September and October is also included.

Twenty meters should continue to be the best band for DX propagation from mid-September to mid-October. The band should open in almost all directions for a few hours after sunrise, and remain open to several different areas of the world throughout most of the day and into the early evening. Signals might be a bit stronger than they were during July and August, but the band will close an hour or two earlier because of the shorter period of daylight.

A seasonal improvement is expected for DX conditions on *15 meters*, but solar activity is so low now that considerably fewer openings are expected compared to the past several years. Best time to check the band is from a few hours before noon through the afternoon hours. Best bet for fairly good openings is towards South America, but openings to Africa and the South Pacific should also be possible.

Solar activity is too low for any real *10 meter* DX openings, although some may be possible towards South America and other southern localities during the afternoon hours.

Improved nighttime DX propagation conditions are expected on *40*, *80* and *160 meters*, as a result of seasonally *lower* static levels and the increasing hours of darkness. *Forty* should provide the best chances for DX from sunset through the sunrise period. Be sure to also check *80* and *160 meters* during the hours of darkness and the sunrise period.

LAST MINUTE FORECAST

Day-to-Day Conditions Expected For Sept., 1975

	Expected Signal Quality			
Propagation Index	(4)	(3)	(2)	(1)
Date				
Above Normal: 17	A	A	B	C
High Normal: 12-13, 15-16, 18, 27	B	B	C	D
Low Normal: 1, 6-7, 9-11, 14, 19, 23, 25-26, 28	B	C	D	E
Below Normal: 2-3, 5, 8, 20, 22, 24, 29	C	D	E	E
Disturbed: 4, 21, 30	D-E	E	E	E

Where *expected signal quality is:*

A—Excellent opening, exceptionally strong, steady signals greater than S9+30 dB.

B—Good opening, moderately strong signals varying between S9 and S9+30 dB, with little fading or noise.

C—Fair opening, signals between moderately strong and weak, varying between S3 and S9, with some fading and noise.

D—Poor opening, with weak signals varying between S1 and S3, and with considerable fading and noise.

E—No opening expected.

HOW TO USE THIS FORECAST

1. Find *propagation index* associated with particular band opening from Propagation Charts appearing on the following pages.
2. With the *propagation index*, use the above table to find the expected signal quality associated with the band opening for any day of the month. For example, an opening shown in the charts with a *propagation index* of (3) will be *fair* (c) on Sept. 1, *poor* (D) on Sept. 2-3, and probably not open at all (E) on Sept. 4, etc.

For updated information dial Area Code 516-883-6223 for DIAL-A-PROP, subscribe to bi-weekly MAIL-A-PROP, P.O. Box 86, Northport, NY 11768, or check WWV at 14 minutes past each hour.

Equinoctial Propagation

Mid-September through mid-October marks the fall equinoctial period. A similar period occurs in the spring, between mid-March and mid-April.

The equinoctial period marks the time that the sun is crossing the equator on its apparent travel into southern skies. During this period the hours of daylight and darkness are just about equal in length throughout the world. Sunrise should take place at approximately 6 A.M. local time (7 A.M. daylight) and sunset at 6 P.M. local time (7 P.M. daylight.)

This equalization throughout the world generally results in an *improvement* on long DX openings between the temperate regions of the northern and southern hemispheres, on all h.f. bands. Look for more frequent openings between the USA and South America, South Pacific, South Asia and southern Africa, especially on *20* meters for a few hours after sunrise and again during the early evening hours.

Long-path propagation is usually optimum during the equinoctial period. In western states look for long-path openings from Europe and Africa on 20 meters shortly after sunrise and again during the evening. Stations in eastern states can expect some long-path openings to the South Pacific during the late afternoon and early evening, and to parts of eastern Africa and Asia just after sunrise. Long-path openings may also be possible on *40* meters during the sunrise and sunset periods.

For readers interested in short-skip condi-

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*Radio Propagation Editor, *CQ*, 11307 Clara St., Silver Spring, MD 20902 tions, for openings less than 250 miles try *80* meters during most of the day and *160* meters during the hours of darkness. Between 250 and 750 miles, *40* meters should be optimum from about 9 A.M. to 5 P.M., and *80* meters at other times. For openings between 750 and 1300 miles try *20* meters during most of the daylight hours; *40* meters from sundown to Midnight and *80* meters from Midnight to sunrise. For openings beyond 1300 miles, *20* meters should be best during most of the daylight hours, with *40* meters optimum during most of the hours of darkness.

V.H.F. Ionospheric Openings

Conditions for trans-equatorial, or TE-scatter propagation are usually at their best during equinoctial periods. An occasional *6* meter TE opening should be possible between the southern half of the USA and South America. The best time for TE openings is between 8 and 11 P.M. While most TE openings are of very short duration, some may last for an hour or longer. Waiting for a TE opening on *6* meters requires a lot of patience, and often signals are weak at best, with considerable flutter-type fading.

Although summertime sporadic-E ionization should fall off considerably during September, an occasional *6* meter short-skip opening may still be possible over distances ranging between 1000 and 1300 miles. Best time to check is before Noon and during the early evening.

Auroral activity usually *increases* during equinoctial periods. Look for some good *6* and *2* meter auroral-type openings when conditions on the h.f. bands are *Below Normal* or *Disturbed*. Check the "Last Minute Forecast" at the beginning of this column for those days likely to be in these categories during September.

No major meteor showers are expected during September and few, if any, meteor-scatter openings are likely on the v.h.f. bands.

Sunspot Cycle

The Swiss Federal Observatory at Zurich reports a monthly mean sunspot number of 8.7 for May, 1975. The highest number recorded during the month was 33 on the 2nd. The sun's surface was completely devoid of spots on 13 days. This monthly level results in a *smoothed* sunspot number of 28 centered on November, 1974. A smoothed sunspot number of about 9 is predicted for September, 1975, as the sunspot cycle slowly but steadily declines towards its minimum.

To take into account this minimum period of solar activity some changes have been made in the DX Propagation Charts. Beginning with the Charts in this month's column, forecasts will be made for the *15, 20, 40* and *80* meter bands directly in the Charts. A ** will be used to indicate the best times to check for *10* meter openings, and a * will indicate best times for *160* meter openings.

HOW TO USE THE SHORT-SKIP CHARTS

1. In the Short-Skip Chart, the predicted times of openings can be found under the appropriate distance column of a particular Meter band (10 through 160 Meters), as shown in the left hand column of the Chart. For the Alaska and Hawaii Charts, the predicted times of openings are found under the appropriate Meter band column (15 through 80 Meters) for a particular geographical region of the continental USA, as shown in the left hand column of the Charts. A ** indicates the best time to listen for 10 meter openings; * best times for 160 meter openings.

2. The *propagation index* is the number that appears in ( ) after the time of each predicted opening. On the Short-Skip Chart, where two numerals are shown within a single set of parenthesis, the first applies to the shorter distance for which the forecast is made, and the second to the greater distance. The index indicates the number of *days* during the month on which the opening is expected to take place, as follows:

(4) Opening should occur on more than 22 days
(3) " " " between 14 and 22 days
(2) " " " between 7 and 13 days
(1) " " " on less than 7 days

Refer to the "Last Minute Forecast" at the beginning of this column for the actual *dates* on which an opening with a specific propagation index is likely to occur, and the signal quality that can be expected.

3. Times shown in the Charts are in the 24-hour system, where 00 is midnight; 12 is noon; 01 is 1 A.M.; 13 is 1 P.M., etc. On the Short-Skip Chart appropriate *daylight* time is used at the *path midpoint*. For example, on a circuit between Maine and Florida, the time shown would be EDT; on a circuit between N.Y. and Texas, the time at the midpoint would be CDT, etc. Times shown in the Hawaii Chart are in HST. To convert to daylight time in other USA time zones, *add* 3 hours in the PDT zone; 4 hours in MST zone; 5 hours in CDT zone; and 6 hours in EDT zone. *Add* 10 hours to convert from HST to GMT. For example, when it is 12 noon in Honolulu, it is 15 or 3 P.M. in Los Angeles; 18 or 6 P.M. in Washington D.C; and 22 GMT. Time shown in the Alaska Chart is given in GMT. To convert to daylight in other areas of the USA, *subtract* 7 hours in the PDT zone, 6 hours in MDT zone, 5 hours in CDT zone and 4 hours in EDT zone. For example, at 20 GMT it is 16 or 4 P.M. in N.Y.C.

4. The Short-Skip Chart is based upon a transmitted power of 75 watts c.w. or 300 watts p.e.p. on sideband; The Alaska and Hawaii Charts are based upon a transmitter power of 250 watts cw or 1 kw p.e.p. on sideband. A dipole antenna a quarter-wavelength above ground is assumed for 160 and 80 meters, a half-wave above ground on 40 and 20 meters, and a wavelength above ground on 15 and 10 meters. For each 10 db gain above these reference levels, the *propagation index* will increase by one level; for each 10db loss, it will lower by one level.

5. Propagation data contained in the Charts has been prepared from basic data published by the Institute For Telecommunication Sciences of the U.S. Dept. of Commerce, Boulder, Colorado, 80302.

CQ DX Contest Special

This year's *CQ* Worldwide DX Contest will be held on the following dates:

October 25-26	Phone Section
November 29-30	C.w. Section

Following the practice of the past 24 years, next month's PROPAGATION column will be devoted to a special, comprehensive forecast which will cover both Sections of the Contest.

Regular subscribers to Mail-A-Prop will receive an even more comprehensive forecast a few days before each Section of the Contest begins. An annual subscription rate to this bi-weekly propagation newsletter is $25, postpaid.

For readers not yet subscribers, a special two-month introductory subscription will be available for October and November, covering both Sections of the Contest, for $5, postpaid. Checks for this special subscription should be sent to Mail-A-Prop, P.O. Box 86, Northport, NY 11768 *before* October 1.

73, George, W3ASK

CQ Short-Skip Propagation Chart
September & October, 1975
Local Daylight Savings Time At Path Mid-Point

Band (Meters)	*Distance Between Stations (Miles)*			
	50-250	*250-750*	*750-1300*	*1300-2300*
10	*Nil*	10-20 (0-1)	10-20 (1)	10-20 (1-0)
15	*Nil*	10-20 (0-1)	08-10 (0-1) 10-17 (1-2) 17-22 (1)	08-10 (1) 10-17 (2) 17-19 (1) 19-22 (1-0)
20	*Nil*	08-10 (0-1) 10-12 (0-2) 12-15 (0-3) 15-17 (0-2) 17-22 (0-1)	08-10 (1-2) 10-12 (2-4) 12-15 (3-4) 15-17 (2-4) 17-20 (1-3) 20-22 (1-2) 22-08 (0-1)	08-09 (2-1) 09-10 (2) 10-14 (4-2) 14-16 (4-3) 16-17 (4) 17-18 (3-4) 18-20 (3) 20-22 (2) 22-00 (1) 00-06 (0-1) 06-08 (1)
40	08-10 (0-2) 10-12 (1-3) 12-16 (2-4) 16-18 (2-3) 18-20 (1-2) 20-22 (0-1)	08-10 (2-3) 10-12 (3) 12-16 (4-2) 16-18 (3) 18-20 (2-4) 20-22 (1-4) 22-00 (0-3) 00-03 (0-2) 03-05 (0-1) 06-08 (0-2)	08-10 (3-2) 10-12 (3-1) 12-16 (2-1) 16-18 (3-2) 18-20 (4-3) 20-22 (4) 22-00 (3-4) 00-03 (2) 03-05 (1-2) 06-08 (2-3)	08-10 (2-1) 10-16 (1-0) 16-18 (2-1) 18-20 (3-2) 20-00 (4-3) 00-06 (2-3) 06-08 (3-2)
80	07-09 (3-4) 09-12 (4) 12-19 (4-3) 19-22 (4) 22-04 (3-4) 04-07 (2-3)	07-09 (4-2) 09-12 (4-1) 12-17 (3-1) 17-19 (3-2) 19-21 (4-3) 21-04 (4) 04-06 (3-4) 06-07 (3)	07-09 (2-1) 09-17 (1-0) 17-19 (2-1) 19-21 (3-2) 21-22 (4-3) 22-04 (4) 04-06 (4-2) 06-07 (3-2)	07-09 (1) 09-17 (0) 17-19 (1) 19-21 (2) 21-22 (3-2) 22-04 (4-3) 04-06 (2) 06-07 (2-1)
160	17-19 (1-0) 19-21 (2-1) 21-06 (4) 06-08 (3-2) 08-10 (2-1) 10-12 (1-0)	18-20 (1-0) 20-21 (1) 21-03 (4-3) 03-06 (3-2) 06-08 (2-1) 08-10 (1-0)	20-21 (1-0) 21-23 (3-1) 23-03 (3) 03-06 (2-1) 06-08 (1)	21-23 (1-0) 23-03 (3-2) 03-06 (1) 06-08 (1-0)

ALASKA
Openings Given In GMT

To:	*15 Meters*	*20 Meters*	*40 Meters*	*80 Meters*
Eastern States	21-23 (1)	18-21 (1) 21-23 (2) 23-01 (1)	08-12 (1)	*Nil*
Central States	21-00 (1)	19-22 (1) 22-00 (2) 00-03 (1)	08-13 (1)	09-12 (1)
Western States	20-21 (1) 21-23 (2) 23-01 (1)	17-18 (1) 18-21 (2) 21-01 (3) 01-02 (2) 02-04 (1)	08-11 (1) 11-14 (2) 14-16 (1)	11-14 (1)

HAWAII
Openings Given In Hawaiian Standard Time

To:	*15 Meters*	*20 Meters*	*40 Meters*	*80 Meters*
Eastern States	11-14 (1)	05-06 (1) 06-08 (2) 08-13 (1) 13-16 (2) 16-18 (1)	17-19 (1) 19-21 (2) 21-00 (3) 00-02 (2) 02-03 (1)	19-20 (1) 20-23 (2) 23-02 (1)
Central States	08-12 (1) 12-15 (2) 15-16 (1)	05-06 (1) 06-09 (2) 09-13 (1) 13-15 (2) 15-17 (3) 18-19 (1)	17-19 (1) 19-21 (2) 21-02 (3) 02-04 (2)	19-20 (1) 20-01 (2)* 01-03 (1)
Western States	08-10 (1) 10-12 (2) 12-14 (3)** 14-15 (2) 15-17 (1)	06-07 (1) 07-10 (3) 10-12 (2) 12-14 (3) 14-16 (4) 16-17 (3) 17-18 (2) 18-20 (1)	17-18 (1) 18-19 (2) 19-00 (4) 00-03 (3) 03-06 (2) 06-07 (1)	18-20 (1) 20-22 (2)* 22-03 (3)* 03-04 (2)* 04-06 (1)

See "How To Use Short-Skip Charts" in box at the beginning of this column.

Note: The Alaska and Hawaii Propagation Charts are intended for distances *greater* than 1300 miles. For shorter distances, use the preceding Short-Skip Propagation Chart.

* Indicates best time for 160 Meter opening.

** Indicates best time for 10 Meter opening.

September 15—October 15, 1975
Time Zone: EDT (24-Hour Time)
EASTERN USA TO:

	15 Meters	*20 Meters*	*40 Meters*	*80 Meters*
Western & Central Europe & North Africa	10-15 (1)	07-08 (1) 08-10 (3) 10-12 (2) 12-16 (3) 16-17 (2) 17-18 (1)	18-19 (1) 19-20 (2) 20-02 (3) 02-04 (2) 04-05 (1)	20-22 (1) 22-01 (2)* 01-04 (1)
Northern Europe & European USSR	10-13 (1)	07-08 (1) 08-10 (2) 10-12 (1) 12-16 (2) 16-17 (1)	18-20 (1) 20-04 (2) 04-05 (1)	21-04 (1)
Eastern Mediterranean & Middle East	10-14 (1)	07-08 (1) 08-09 (2) 09-14 (1) 14-16 (2) 16-17 (1)	19-21 (1) 21-00 ()2 00-01 (1)	22-00 (1)
Western Africa	09-11 (1) 11-13 (2)** 13-14 (3)** 14-15 (2) 15-16 (1)	08-10 (1) 13-15 (1) 15-16 (2) 16-19 (3) 19-20 (2) 20-21 (1)	20-23 (1) 23-02 (2) 02-04 (1)	22-03 (1)
Eastern & Central Africa	11-13 (1) 13-15 (2) 15-16 (1)	13-15 (1) 15-18 (2) 18-19 (1)	21-02 (1)	22-01 (1)
Southern Africa	09-11 (1) 11-14 (2)** 14-15 (1)	08-10 (1) 13-15 (1) 15-18 (2) 18-20 (1) 23-01 (1)	19-22 (1) 22-00 (2) 00-02 (1)	23-01 (1)
Central & South Asia	*Nil*	07-08 (1) 08-10 (2) 10-12 (1) 19-22 (1)	05-07 (1) 20-23 (1)	*Nil*
Southeast Asia	17-19 (1)	07-08 (1) 08-10 (2) 10-12 (1) 16-18 (1) 20-22 (1)	06-08 (1)	*Nil*
Far East	17-19 (1)	08-09 (1) 09-10 (2) 10-12 (1) 17-19 (1) 19-21 (2) 21-22 (1)	06-08 (1)	*Nil*

South Pacific & New Zealand	14-16 (1) 16-18 (2)** 18-19 (1)	07-08 (1) 08-11 (2) 11-14 (1) 16-20 (1) 20-23 (2) 23-01 (1)	01-02 (1) 02-03 (2) 03-06 (3) 06-08 (2) 08-09 (1)	03-05 (1) 05-07 (2)* 07-08 (1)
Austral-asia	17-19 (1)**	07-08 (1) 08-10 (2) 10-12 (1) 14-16 (1) 16-18 (2) 18-21 (1) 21-23 (2) 23-01 (1)	02-04 (1) 04-06 (2) 06-07 (3) 07-08 (2) 08-09 (1)	04-05 (1) 05-06 (2)* 06-07 (1)
Caribbean, Central America & Northern Countries of South America	09-10 (1) 10-13 (2)** 13-16 (3)** 16-17 (2) 17-18 (1)	07-08 (1) 08-09 (3) 09-10 (4) 10-15 (2) 15-17 (3) 17-19 (4) 19-20 (3) 20-21 (2) 21-22 (1)	19-20 (1) 20-21 (2) 21-04 (4) 04-06 (3) 06-07 (2) 07-08 (1)	21-23 (1) 23-04 (2)* 04-07 (1)
Peru, Bolivia, Paraguay, Brazil, Chile, Argentina & Uruguay	09-10 (1) 10-11 (2) 11-14 (1) 14-17 (2)** 17-18 (1)	07-08 (1) 08-10 (2) 10-11 (1) 14-16 (1) 16-18 (2) 18-20 (3) 20-21 (2) 21-23 (1)	21-23 (1) 23-01 (2) 01-03 (1) 03-06 (2) 06-07 (1)	02-06 (1)*
McMurdo Sound, Antarctica	15-17 (1)	07-09 (1) 18-20 (1) 20-22 (2) 22-00 (1)	00-03 (1) 03-05 (2) 05-07 (1)	04-06 (1)

Time Zones: CDT & MDT (24-Hour Time)

CENTRAL USA TO:

	15 Meters	*20 Meters*	*40 Meters*	*80 Meters*
Western & Central Europe & North Africa	10-14 (1)	07-08 (1) 08-10 (2) 10-13 (1) 13-14 (2) 14-15 (3) 15-16 (2) 16-17 (1)	18-20 (1) 20-23 (2) 23-01 (3) 01-02 (2) 02-04 (1)	21-23 (1) 23-01 (2)* 01-02 (1)
Northern Europe & European USSR	10-13 (1)	07-08 (1) 08-10 (2) 10-12 (1) 12-15 (2) 15-16 (1)	20-23 (1) 23-01 (2) 01-02 (1)	22-01 (1)
Eastern Mediter-ranean & Middle East	10-13 (1)	07-08 (1) 08-09 (2) 09-15 (1) 15-16 (2) 16-17 (1)	20-23 (1)	21-23 (1)
Western Africa	09-12 (1) 12-14 (2)** 14-15 (1)	07-09 (1) 13-15 (1) 15-16 (2) 16-18 (3) 18-19 (2) 19-20 (1)	20-23 (1) 23-01 (2) 01-02 (1)	23-01 (1)
Eastern & Central Africa	12-15 (1)	07-09 (1) 13-16 (1) 16-18 (2) 18-19 (1)	21-00 (1)	22-23 (1)
Southern Africa	09-11 (1) 11-14 (2)** 14-15 (1)	07-09 (1) 12-14 (1) 14-16 (2) 16-17 (3) 17-18 (2) 18-19 (1) 22-00 (1)	20-21 (1) 21-23 (2) 23-01 (1)	21-23 (1)
Central & South Asia	*Nil*	07-08 (1) 08-10 (2) 10-12 (1) 18-20 (1)	06-08 (1) 19-21 (1)	*Nil*
Southeast Asia	17-19 (1)	07-08 (1) 08-10 (2) 10-13 (1) 18-21 (1)	05-08 (1)	*Nil*
Far East	16-18 (1)	07-08 (1) 08-10 (2) 10-12 (1) 17-19 (1) 19-21 (2) 21-23 (1)	03-05 (1) 05-07 (2)	06-08 (1)
South Pacific & New Zealand	12-15 (1) 15-18 (2)** 18-19 (1)	07-08 (1) 08-10 (3) 10-12 (2) 12-18 (1) 18-20 (2) 20-22 (3) 22-00 (2) 00-02 (1)	00-01 (1) 01-07 (3) 07-08 (2) 08-09 (1)	02-04 (1) 04-07 (2)* 07-08 (1)
Austral-asia	16-18 (1)**	06-07 (1) 07-08 (2) 08-09 (3) 09-11 (2) 11-17 (1) 17-18 (2) 18-20 (1) 20-22 (2) 22-00 (1)	02-03 (1) 03-05 (2) 05-07 (3) 07-08 (2) 08-09 (1)	05-06 (1) 06-07 (2)* 07-08 (1)
Caribbean, Central America & Northern Countries of South America	09-10 (1) 10-11 (2)** 11-13 (3)** 13-15 (4)** 15-16 (3)** 16-17 (2) 17-18 (1)	06-07 (1) 07-08 (3) 08-10 (4) 10-12 (3) 12-15 (2) 15-17 (3) 17-19 (4) 19-20 (3) 20-21 (2) 21-22 (1)	19-20 (1) 20-21 (2) 21-01 (3) 01-05 (4) 05-06 (3) 06-07 (2) 07-08 (1)	20-23 (1) 23-06 (2)* 06-07 (1)
Peru, Bolivia, Paraguay, Brazil, Chile, Argentina, & Uruguay	09-10 (1) 10-11 (2) 11-13 (1) 13-17 (2)** 17-18 (1)	07-08 (1) 08-09 (2) 09-11 (1) 13-16 (1) 16-17 (2) 17-20 (3) 20-21 (2) 21-23 (1)	21-23 (1) 23-02 (2) 02-04 (1) 04-06 (2) 06-07 (1)	23-02 (1) 02-04 (2)* 04-05 (1)

HOW TO USE THE DX PROPAGATION CHARTS

1. Use Chart appropriate to your transmitter location. The Eastern USA Chart can be used in the 1, 2, 3, 4, 8, KP4, KG4 and KV4 areas in the USA and adjacent call areas in Canada; the Central USA Chart in the 5, 9 and 0 areas; the Western USA Chart in the 6 and 7 areas, and with somewhat less accuracy in the KH6 and KL7 areas.

2. The predicted times of openings are found under the appropriate meter band column (15 through 80 Meters) for a particular DX region, as shown in the left hand column of the Charts. A ** indicates the best time to listen for 10 meter openings; * best times for 160 meter openings.

3. The *propagation index* is the number that appears in ( ) after the time of each predicted opening. The index indicates the number of *days* during the month on which the opening is expected to take place as follows:

(4) Opening should occur on more than 22 days
(3) " " " between 14 and 22 days
(2) " " " between 7 and 13 days
(1) " " " on less than 7 days

Refer to the "Last Minute Forecast" at the beginning of this Propagation column for the actual *dates* on which an opening with a specific propagation index is likely to occur, and the signal quality that can be expected.

4. Time shown in the Charts are in the 24-hour system, where 00 is midnight; 12 is noon; 01 is 1 A.M., 13 is 1 P.M., etc. Appropriate *daylight* time is used, *not* GMT. To convert to GMT, add to the times shown in the appropriate Chart 7 hours in the PDT Zone, 6 hours in the MDT Zone, 5 hours in the CDT Zone and 4 in the EDT Zone. For example, 14 in Washington, D.C. is 18 GMT and 20 in Los Angeles is 03 GMT, etc.

5. The charts are based upon a transmitter power of 250 watts c.w., or 1 kw, p.e.p. on sideband, into a dipole antenna a quarter-wavelength above ground on 160 and 80 meters, a half-wave above ground on 40 and 20 meters, and a wavelength above ground on 15 and 10 meters. For each 10 db gain above these reference levels, the *propagation index* will increase by one level; for each 10 db loss, it will lower by one level.

6. Propagation data, contained in the Charts has been prepared from basic data published by the Institute For Telecommunication Sciences of the U.S. Dept. of Commerce, Boulder, Colorado, 80302.

[*continued on page 82*]

THE awards PROGRAM

BY ED HOPPER,* W2GT

Special Honor Roll
(All Counties)
#129—Dr. Bill George, WA5YSC 5-15-75.
#130—Hazel V. Cain, K9QGR 5-16-75.

DWAIN SCHUNKE, WB6RMZ, All Counties #103, sent along this "Story":

"Born in Lodi, California in 1920 and graduated from the local high school in 1938. Attended Stamford University and graduated in 1942 with a BA in Business Administration. Then worked in various wartime industries for one year. Served three years with the Merchant Marine until 1946.

"In 1946 I entered into the retail men's wear business with my father. I took over the entire business in 1958 when my father retired. In February 1972 I retired from business and then could spend more time on the air.

"My interest in electronics started in 1963 and I made up dozens of Heathkits. Got my Novice ticket in 1965 and in July of 1966 I finally got my General. About one year later I received my Advanced License. I soon got interested in WAS and got my last state on the County Hunters Net in 1967 from K1WQU. For a couple of years I chased DX and now have over 230 countries.

"In 1969 I started working for 5BWAS. A short time later I stopped on the County Hunters Net and have more or less been there ever since. Finally in April 1973 I got my last County (Leake, Mississippi) from K5JBC who made a special trip for me. Thanks very much to Clint and all the others who made it all possible.

Dwain Schunke, WB6RMZ, (Believe he NOW has mobile unit in car).

"Currently I am trying for the second time around and now have about 2640. I have never gone mobile but by the time you read this, I hope to have the necessary set-up to give out a number of Counties from out in this area."

Our records show that Dwain was issued USA-CA-500 through 2500, endorsed All 14 SSB Mobiles n May 1971. USA-CA-3000, also endorsed All 14 SSB Mobiles was added in January 1973, *All Counties* was issued April 25, 1973.

Awards Issued

First, may I correct a couple of errors that cropped up when the June 1975 column got into print. The "Thanks to Bea, WA2GPT" ended up under Howie, K1VSJ and some of Howie's and Beas' credits got mixed.

Bea Dietz, WA2GPT was issued USA-CA-2500 and 3000 Mixed.

Howie Bromberg, K1VSJ acquired USA-CA-2500 endorsed All 14, All SSB, All Mobile to Mobile.

Now for this column:

Dr. Bill George, WA5YSC claimed USA-CA-3000 endorsed All SSB and *All Counties* Mixed.

Hazel Cain, K9QGR (Wife of Claude, K9-HRC, *All Counties* #104) who had received USA-CA-500 #51 in January 1962, finally found time for all the paper work and got USA-CA-1000 through USA-CA-2500 endorsed All SSB, All 14, All Mobiles. USA-CA-3000 endorsed All SSB, All 14. And *All Counties* endorsed All Phone.

John Moore, W5UUM applied for USA-CA-500 through USA-CA-2500 endorsed All SSB, All Mobiles; and USA-CA-3000 endorsed All SSB.

"Bing" Miller, W0GV, who used to put out that fine County Hunter Newsletter a few years back, decided that as long as he was getting close to All Counties, he better get his paper work in proper order. He was issued USA-CA-500 endorsed All SSB, All A-1, All 14, All Mobiles. USA-CA-1000 through 2000 endorsed All SSB, All 14, All Mobiles. USA-CA-2500 endorsed All SSB, All 14 and USA-CA-3000 Mixed.

Charlie Gagnon, Jr., W1LQQ added USA-CA-1500 and 2000 endorsed All SSB, to his collection.

Awards

Holy Year Award: Issued for QSOs during the Holy Year, December 2, 1973 to the end of 1975. Requirements: QSO with HV1CN or HV3SJ. Europeans required to QSO 10 Rome stations, all others required to also have QSOs with 7 Rome stations. You must have the

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*P.O. Box 73, Rochelle Park, N.J. 07662.

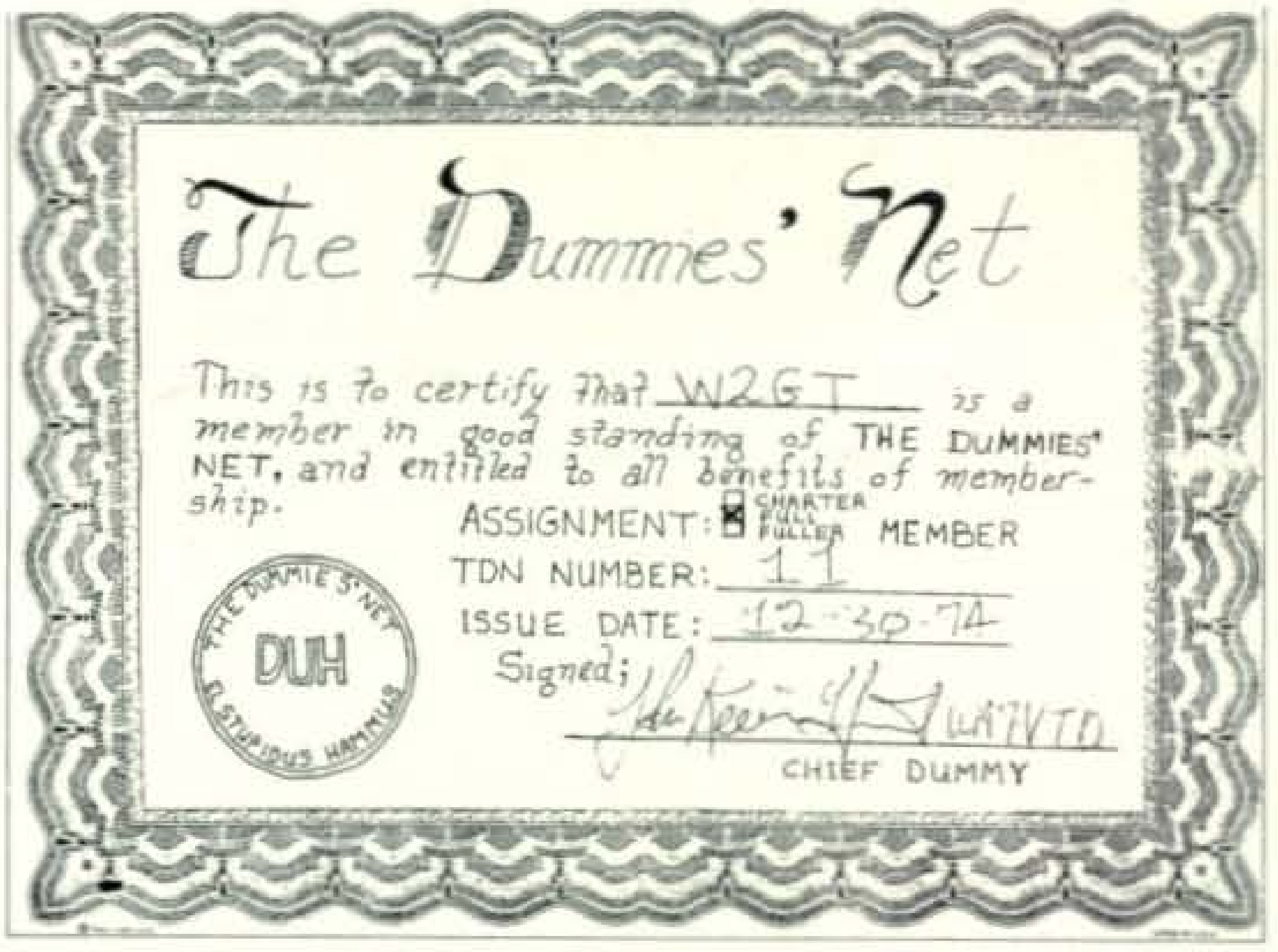
QSLs (carefully check QSLs as there have been many pirate HV stations). Send GCR List —all log data checked by 2 other amateurs. Cost is 10 IRCs but for countries without IRCs (Communist Countries) the award is free. Send certified data, fee to: Associazione Radiotecnia Italiana (ARI), Box 361, 00100 Rome, Italy. Again thanks for this data to Father Ed. HV3SJ, Bernie, W8IMZ and Frank, W1WY.

Pandora's Box DX Award: Presented to amateur radio stations throughout the world for working members stations of Pandora's Box DX Net. Requirements: Work ten (10) members in different countries (per ARRL current list). These contacts must include five (5) separate "K" calls from the Pacific area. Pacific member stations must work ten (10) member stations *EXCLUDING* Pacific "K" calls. All contacts to be made after 1 February 1972 and minimum report must be 3 × 3. Honor system used, and thus no confirmation of QSOs need be submitted. Submit list of stations worked in alphabetical (by call) order including date/time (GMT) and report received. Send this (with 2 IRCs please to cover postage) to: OA4OS, Natan Sterental, P.O. Box 4147, Lima, Peru, South America. Net members from an old list include: KA2AI, KA8RO, KC6BK, KC6RS, KH6BB, KH6CCL, KH6-GCY, KH6GDR, KH6HDA, KH6HIF, KH6-HMD, K5CIT/KH6, KH6EDY, KJ6CW, KL7AIZ, KM6DX, KP4DLW, KR6LP, KS6-EM, KS6DU, KZ5JL, KZ5YY, WA6FSC/DX, CP1FW, CR6GA, CR7CH, CR7IK, FL8MM, FO8DF, KX6IQ, I8IPB, JA1EOD, MP4BIN, MP4TDM, OA4OS, SV1GA, TT8AC, UA6-LAZ, VK4ALE, VK4BS, YJ8BL, ZD9GA, ZE4JS, ZE6JP, ZE6JW, ZS2RM, ZS6IW, ZS6-MP, 3D2FM, 4X4JU, 5H3LV, 5R8AB, 5R8-AP, 5W1AU, 5X5NK, 7Q7AA, 7Q7LZ, 9J2JN.

The Dummies Net: This Award given for a unique reason—Charter Membership granted to anyone sending a legal-size s.a.s.e. with 30¢ postage. Full Membership granted to anyone who besides sending the above, has failed one Ham exam during his/her ham career. If applicant has flunked a ham exam more than one, Fuller Membership is granted. Send to: The Dummies Net (TDN) Att: WA7VTD or WA7VTG, 2222 Duncan Drive, Missoula, Montana 59801. Yes, I am a member, back in 1921 when I was a scared little country boy, I did fail—Hi—Oh yes, be sure to mark your s.a.s.e. First Class Mail, I did not and my certificate took months to arrive.

Notes

How was *my* month? Thanks, I thought you'd never ask. *Mine* was *Great!* No, I was not one of the lucky 12,000 who got to the Dayton (Ohio) Hamfest, and no, I was not able to get to MARAC 1975 at Dogpatch, Arkansas, but I did enjoy the Northern New Jersey Chapter QCWA dinner at our local Ramada Inn. I did enjoy giving a talk/demonstration on Amateur Radio to our Rotary Club at our local Dan Dowds Steak House. I also enjoyed the fine First-class C.W. Operators' Club Dinner-get-together at the Holiday Inn, Spring Valley, N.Y. Guests there included G8VG and Wife, GD4AM, VE1CD, ex-XW8CR now K4EZL, many W1s, W2s, W3s, W4s, W6VD, W6YY and W9VW.



The Dummes' Net

This is to certify that W2GT is a member in good standing of THE DUMMIES' NET, and entitled to all benefits of membership.

ASSIGNMENT: ☐ CHARTER ☒ FULL ☐ FULLER MEMBER

TDN NUMBER: 11

ISSUE DATE: 12-30-74

Signed; WA7VTD

CHIEF DUMMY

DUH

The Dummies Net Membership.

In response to the mention of Dave, KH6BIH on page 56 of Feb. '75 *CQ* by Steve, W1AGE, a nice letter was received from "Pete" Billon, WA6MWG/KH6FLC (USA-CA-500-#153 of 12-10-62). "Pete" has been QSL manager for Dave, KH6BIH for years. Dave is blind and deaf but has a special speaker that he feels with his finger tips for c.w. and can copy 25/30 w.p.m. that way. He is in Hawaii County and on the air daily from 2200Z on 14.074, until about 0100Z and QSLs via Pete at 4040 Via Opata, Palos Verdea Est., California 90274.

Congratulations to Bill Clark, W6KRO who received the Nishinomuja Leopon Award (Japan) #586 endorsed the first issued for All 7MHz All 2×CW. He also received AJD & JCC-100 Awards (Japan).

Through the courtesy of friends, "Digger", WA2DIG and Gius, IT1AGA/IT9AGA, here is some data on IT1AGA, Giuseppe de Luca,

[*continued on page 59*]

USA-CA HONOR ROLL

3000	
WA5YSC	150
K9QGR	151
W5UUM	152
W0GV	153

2500	
K9QGR	188
W5UUM	189
W0GV	190

2000	
W1LQQ	221
K9QGR	222
W5UUM	223
W0GV	224

1500	
W1LQQ	263
K9QGR	264
W5UUM	265
W0GV	266

1000	
K9QGR	354
W5UUM	355
W0GV	356

500	
W5UUM	1047
W0GV	1048

Contest Calendar

BY FRANK ANZALONE,* W1WY

Calendar of Events

Sept.	6-7	ARRL VHF QSO Party
*Sept.	6-8	Maryland/DC QSO Party
*Sept.	6-8	Four Land QSO Party
*Sept.	6-8	Kentucky QSO Party
*Sept.	13-14	Pennsylvania QSO Party
*Sept.	13-15	Washington State QSO Party
*Sept.	13-14	European DX Phone Contest
Sept.	17-19	YL Howdy Days
Sept.	20-21	VE/W Contest
Sept.	20-21	Scandinavian C.W. Contest
Sept.	27-28	Scandinavian Phone Contest
Sept.	27-29	Delta QSO Party
Oct.	4-5	California QSO Party
Oct.	4-5	Rocky Mountain QSO Party
Oct.	4-5	VK/ZL/ Oceania Phone
Oct.	11-12	VK/ZL/Oceania C.W.
Oct.	12	RSGB 21/28 MHz Phone
Oct.	15-16	YL Anniv. C.W. Party
Oct.	17-19	Boy Scouts Jamboree
Oct.	18-19	WADM C.W. Contest
Oct.	18-19	RSGB 7 MHz C.W. Contest
Oct.	18-19	Manitoba QSO Party
Oct.	**25-26**	**CQ WW DX Phone Contest**
Nov.	1-3	CHC/FHC/HTH Party
Nov.	1-2	RSGB 1 MHz Phone Contest
Nov.	6-7	YL Anniv. Phone Party
Nov.	8-9	European RTTY DX Contest
Nov.	9	Czechoslovakian Contest
Nov.	8-9	ARRL C.W. Sweepstakes
Nov.	22-23	ARRL Phone Sweepstakes
Nov.	**29-30**	**CQ WW DX C.W. Contest**

*Covered last month

YLRY "Howdy Days"

Starts: 1800 GMT Wednesday, September 17
Ends: 1800 GMT Friday, September 19

This activity is for YL's and scores will be based on contacts between YL's only. All bands and modes may be used, but cross-band and Net contacts do not count.

Score 2 points for each YLRL member worked and 1 point for each nonmember contacted. Only one contact with the same station regardless of band. There is no multiplier, just add the QSO points.

The top scoring YLRL member will receive her choice of a YLRL pin, charm or stationery. The highest scoring non-member receives a one year membership in the YLRL.

Logs must be received before October 19th and go to: Myrtle Cunningham, WA6ISY, 1105 East Acacia Ave., El Segundo, CA 90245.

VE/W Contest

C.W.—0000 to 2400 GMT Sat. Sept. 20
Phone—0000 to 2400 GMT Sun. Sept. 21

The VE/VO's will be working the W/K's in the "General" portion of the US bands in this one.

This year's contest is divided into two classes, c.w. and phone, with separate operating times for each. Therefore each is logged separately.

Only 18 hours total operating time may be used in the 24 hour period of each contest. The minimum off period is 15 mins. which must be shown on log.

The same station may be worked on each band for QSO and multiplier credit. And there are two type of entries, single and multi-operator.

Exchange: RS(T), year first licensed and QTH. ARRL section for W/K, geographical areas for VE/VO. (9 provinces plus Nfld., Lab., Yukon, N.W.T.)

Scoring: Two points per QSO. VE/VO's use US ARRL sections worked on each band for their multiplier. W/K's use Canadian areas. (max. of 13 on each band) In addition, a multiplier of 10 has been instituted for W/K's to equalize the W/VE scores. (QSO's × area multiplier × 10 = Final Score)

Awards: Certificates to the top scorers in each class in each section if there are at least 3 entries for that section. (Min. of 25 QSO's) The Montreal ARC is donating Plaques to the Top Scoring entry, c.w. and phone, in the US and Canada.

Summary and check sheets are a must as is a declaration that all rules and regulations have been observed. A dupe check sheet is required for logs with 200 or more contacts. (Same available by sending s.a.e. plus IRC to address below.)

Reduction of claimed score by 2% or more because of duplicate contacts and etc. may mean disqualification.

Mailing deadline is October 31st to: VE/W Contest Committee, P.O. Box 2206, Dorval Station 780, Quebec, Canada.

Scandinavian Activity Contest

C.W.—Sept. 20-21 *Phone*—Sept. 27-28
Starts: 1500 GMT Saturday
Ends: 1800 GMT Sunday

It's the world working the Scandinavians on all bands, 3.5 thru 28 MHz in the 17th S.A.C. Countries are: LA/LJ/LG, JW, JX, OH, OH0, OJ0, OX, OY, OZ, SM/SK/SL.

Classes: Single operator and multi-operator, single and multi transmitter. Multi transmitter stations must use separate series of serial numbers for each band. Club stations are classed as multi-operator.

---

*14 Sherwood Road, Stamford, Conn. 06905.

Exchange: Five and six figures, RS(T) plus a progressive QSO no. starting with 001.

Scoring: One point for each completed QSO. The multiplier is the sum total of SAC countries worked on each band, as listed above. Maximum of 10 per band. Scoring all band only.

Awards: Certificates for all classes, to the two top scorers, both phone and c.w., in each country and USA call area.

Phone and c.w. are separate contests. Include a summary sheet showing the scoring and other information, your name and address in BLOCK LETTERS, and a signed declaration that all rules and regulations have been observed.

Mailing deadline is October 15th. This year logs go to: SRAL Contest Committee, Box 306, SF—00101 Helsinki 10, Finland.

Delta QSO Party

Starts: 2000 GMT Saturday, September 27
Ends: 2000 GMT Monday, September 29

This is the 6th annual QSO party sponsored by the Delta Division of the ARRL. Delta stations (Ark., La., Miss., Tenn.) may work stations both in and outside their boundaries, others only Delta stations. The same station may be worked on each band and mode, portable and mobile each county change.

Exchange: QSO no., RS(T) and QTH. County and state for Delta, ARRL section for others.

Scoring: For Delta, QSO's times ARRL sections worked. (max. of 75) Others, QSO's times the Delta counties worked. (max of 316) DX stations may be worked but QSO points only.

Frequencies: C.W. — 3550, 7050, 14050, 21050, 28050. Phone — 3990, 7290, 14290, 21390, 28590. Novice — 3775, 7175, 21125, 28125.

Certificate Awards:

A. Achievement: All stations contacting 5 or more stations in each of the 4 Delta states.

B. Delta: To the 3 highest scoring stations in each of the 4 Delta states, 4th and 5th if warranted.

C. Others: To the highest scoring station in each ARRL section and country, 2nd and 3rd if warranted.

D. Plaques: Top scorer, in an outside the Delta division, and the Top scoring portable and mobile Delta station.

Mailing deadline October 21st to: Malcolm P. Keown, W5RUB, 213 Moonmist, Vicksburg, Miss. 39180.

California QSO Party

Starts: 1800 GMT Saturday, October 4
Ends: 2400 GMT Sunday, October 5

This year's party is sponsored by the Northern California Contest Club.

At a DARC DX Committee meeting early last Spring, DK2BI and DJ2YA were presented the W4BVV Operator's Trophy for high European scores in the 1972 and 1973 CQ World Wide DX Phone Contest. L. to R.—DJ3KR, DJ2YA, DL3RK and DK2BI.

Operating time is limited to 24 hours out of the 30 hour contest period. Off time must be at least 15 minutes and shown on log.

The same station may be worked once per band and mode, portables and mobiles each county change. Cal. stations may work each other for QSO points and one multiplier. DX stations for QSO points only.

Exchange: QSO no., and QTH. County for Cal., state, province or country for others.

Scoring: Two points per QSO. Cal. stations use states plus VE call districts (max. of 8) worked for their multiplier. Non-Cal. stations Cal. counties. (max. of 58)

Frequencies: C.W. — 1805, 3560, 7060, 14060, 21060, 28060. Phone — 1815, 3895, 7230, 14280, 21355, 28560. Novice — 3725, 7125, 21125, 28125. Try 10 on the hour, 15 on the half hour.

Awards: Certificates to the Top scorers in each Cal. county, state, VE province and country, 2nd and 3rd place if justified. Also to the Top mobile, portable, multi-single, multi-multi and club submitting highest aggregate score.

Include a summary sheet with your entry, showing the scoring, type of entry and etc. A large s.a.s.e. will get you the results.

Mailing deadline is October 31st to: NCCC, c/o John Minke, W6KYA, 6230 Rio Bonito Drive, Carmichael, Calif. 95608.

Rocky Mountain QSO Party

Three Periods *(GMT)*
2100 to 2400 Saturday, October 4
0100 to 0500 Sunday, October 5
1800 to 2100 Sunday, October 5

Each state in the Rocky Mountain Division is having its own QSO party during the above time periods. Those participating are Colorado,

1975 B.A.R.T.G. RTTY Results

North America

W3EKT	219,520	WA0YDJ/4	44,100
KZ5BH	197,100	WB7APW	41,280
K4GMH	152,338	KZ5OD	36,250
W4CQI	145,530	K4GJW	31,900
W1GKJ	132,924	W7CBY	21,240
K6WZ	122,436	W1ZXA	20,406
VE5BX	113,880	VE3GUH	18,900
XE1LL	99,502	VE7BDQ	14,280
WB4ELA	95,832	K2RYI	10,112
WA6WGL	88,700	W6AEE	9,220
W1DXQ	84,824	K8KAG	7,600
W0HAH	75,192	VE3BPM	3,300
W8JIN	66,534	WB2DQP	2,400
W7BCT	51,902	W8TCO	960
W3KV	51,156		

Multi-Op. W1MX 84,040

W3EKT was 2nd world high out of a total of 93 entries, and had the highest number of contacts.

New Mexico, Utah and Wyoming.

Stations may be worked only once per band regardless of mode, except mobiles who may be worked in each county change. Inter-division and inter-state contacts are valid.

Exchange: QSO no., RS(T) and QTH. State and county for Rocky Mt. stations. And state, province or country for others.

Scoring: One point per QSO. The multiplier for Rocky Mt. stations is the sum of states, VE provinces, DX countries and Rocky Mt. counties worked. For stations outside the Division the multiplier is the number of counties worked in the state whose party he is participating.

(The way I see it you can participate in four different contests at the same time. And you submit a separate log for each state. One way of getting a lot of activity into one week-end. Ed.)

Frequencies: C.W.—65 kHz from bottom of each band. Phone—Near the edge, between General and Advanced. Novice—Middle of each band.

Appropriate awards will be issued.

All logs to go to: Bill Wageman, K5MAT, 35 San Juan, Los Alamos, NM 87544. Mailing deadline November 1st. Include large s.a.s.e. for awards and/or copy of results.

VK/ZL/Oceania DX Contest

Phone: Oct. 4-5 **C.W.:** Oct. 11-12
Starts: 1000 GMT Saturday
Ends: 1000 GMT Sunday

Stations in the rest of the world will concentrate on working stations in Oceania, with the emphasis on VK/ZL for their multiplier.

Rules apply to stations other than VK/ZL.

Exchange: RS(T) plus a progressive QSO no. starting with 001.

Scoring: *For Oceania:* 2 points for VK/ZL contacts, 1 point with rest of world. *Outside Oceania:* 2 points for VK/ZL contacts, 1 point for Oceania contacts.

Final Score: Total QSO points multiplied by the sum total of VK/ZL call areas worked on all bands. (Single band logs also acceptable.)

Logs: Date/time in GMT, station worked, number sent/rec'd, band, QSO points. Underline each new VK/ZL call area worked on each band. Use separate log sheet for each band. A summary sheet showing the scoring, your name and address in BLOCK LETTERS and a signed declaration that all rules and regulations have been observed.

Awards: Attractive colored pictorial certificates to the top all band scorers, both phone and c.w., in each country and call areas of JA, USSR and W/K. Single band awards if returns warrant.

There is also a s.w.l. section. Only VK/ZL stations are to be logged. Include call of station being worked and serial number sent.

Logs must be in the hands of the committee no later than January 31st 1976. This year they go to: W.I.A. Contest Mgr., G.P.O. Box 1002, Perth 6001, Western Australia. Include a IRC with your entry for copy of results.

RSGB 21/28 MHz Phone Contest

From 0700 to 1900 GMT Sunday, October 12

It's the world working the British Isles (G, GC, GD, GI, GM, GW) on 21 and 28 MHz.

Entries limited to single operator only.

This year the contest has been reduced to 12 hours only and the scoring system has been changed, based on a multiplier system.

The same station may be worked once on each band for QSO and multiplier credit. Use a separate log for each band.

Exchange: The RS report plus a progressive contact number starting with 001.

Scoring: Each QSO with a British Isle station counts 3 points. Multiply total QSO points from both bands by sum of British Isles prefixes worked on each band for final score. (max. of 36 on each band. GB prefx does not count)

No awards were mentioned for overseas stations. Surely this must be an oversight.

There is also a s.w.l. section. Only British Isles stations are to be logged, and scoring is same as indicated above.

Logs should be received no later than December 8th and go to: D. J. Andrews, G3MXJ, 18 Downsview Crescent, Uckfield, Sussex, England.

YL Anniversary Party

C.W.: Oct. 15-16 **Phone:** Nov. 6-7
C.W.—1800 GMT Wed. to 1800 GMT Thurs.
Phone—1800 GMT Thurs. to 1800 GMT Fri.

This is the 36th annual YLRL contest open to all YL's around the world. Contacts with OM stations do not count.

All bands may be used. Phone and c.w. are separate with separate scoring and awards.

Exchange: One point per QSO between stations within an ARRL section, and between DX stations. Two points if between DX and ARRL section stations. Same station may be worked once only.

Multiplier is derived from the number of ARRL sections and DX countries worked. There is also a low power multiplier of 1.25 if input is 150 watts or less, 350 p.e.p. on s.s.b.

Final Score: Total QSO points × ARRL sections and countries × power multiplier if any.

Awards: 1st, 2nd and 3rd place certificates to winners in each call district and DX country. And two Gold Cups, phone & c.w., to the top YLRL members in the world. There are also three special plaques for YLRL members. The Corcoran for the highest combined c.w./phone score in an ARRL area, the Hager to the highest combined score for North and Central America, including Caribbean areas, and one for rest of world.

Compute your score, sign your log and mail no later than November 24th to: Myrtle Cunningham, WA6ISY, 1105 East Acacia Ave., El Segundo, CA 90245.

Editor's Notes

See page **48** of this issue for complete rules for this year's *CQ* World Wide DX Contest. There are no changes over last year's rules. However I recommend that stations planning multi-operator operation check Par. III, Sec. 2a. Multi-operator, Single Transmitter stations are only allowed to use *one* other band during the same time period, providing the station worked is a new multiplier.

Two new Trophies have been added to the Single Band category. USA phone (So. Calif. DX Club) and USA c.w. (No. Illinois DX Club)

We also have new sponsors for the Carib./C.A. awards. Pedro Piza, KP4AST has picked up the Single Band award, and Don Wallace, W6AM the All Band awards.

Our thanks to Gus Kuether, HR2GK and Harold Fox, W3AA who have been donating these awards for the past years.

Sorry that the USSR c.w. results are so late being published, but they have always arrived much later than the other entries. You can now understand why we found it impossible to make an early issue with the complete contest results in previous years when the USSR results were included. 73 for now, Frank, W1WY

Spread The Word

An eye-catching bumper sticker encouraging the man in the street to "Talk to the World—Become A Ham Operator" is available from *CQ* for 25¢ plus a legal-size s.a.s.e. Quantity prices upon request. Write to: *CQ*, 14 Vanderventer Av., Port Washington, NY 11050.

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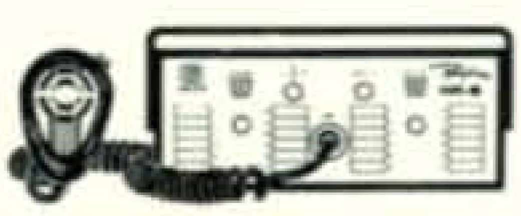
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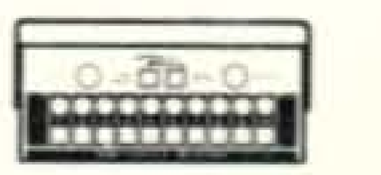
12 Channel-25 Watts
6 Meter FM Transceiver

HRT-2
5 Channel Hand-Held
2 Meter FM Transceiver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FM Scanner Receiver

We offer Test Equipment "As Received" from labs, mfgrs, govt. agencies, etc. All operational, but we guarantee only that equipment is intact. Schematics furnished when available. (Tech Manuals are available from original mfgrs at nominal cost.)

HEWLETT PARCKARD

122AR	Oscilloscope- d.c. to 200 kHz, Dual Trace, 5',	$150.
200CDR	Rack mtd Audio Oscillator- 5 Hz to 600 kHz, variable output, very clean	125.
212A	Pulse Generator - 07 to 10 u/sec.— 50 V. output, good cond	35.
300A	Harmonic Wave Analyzer, good cond	75.
400C	A.C. V.T.V.M.- .001 to 300 v.a.c., good cond.	40.
400DR	A.C. V.T.V.M.- .001 to 300 v.a.c., good cond	50.
410B	A.C. - D.C. V.T.V.M. plus ohms ranges, good cond	75.
505B	Electronic Tachomotor, clean cond	70.
521CR	Counter, 10 Hz to 120 kHz, clean cond (XTAL)	50.
524A, B,D	Counter, 10 Hz to 10 MHz. Large and heavy. Good shape. Cheap. Uses 525 A,B, C, plug-ins	65.
540B	Transfer Oscillator to 400 MHz, good cond	150.
616A	1.8 to 6 GHz Signal Generator, OK cond	280.
618A	3.8 to 7.6 GHz Signal Generator	250.
5246L	Counter, like new cond	850.
715B	Regulated Power Supply;	75.
337B	Modulation Indicator	75.
741A	A.C. - D.C. Differntial V.M. - D.C. Standard	795.

MEASUREMENTS

65B	Signal Generator 75 kHz to 30 MHz	$250.
179B	Pulse Generator	50.
80	Signal Generator 2 to 400 MHz, exc. cond.	225.

BOONTON

160A	"Q" Meter (couple ok)	125.
240A	Sweep Signal Generator 4.5 to 120 MHz....	350.
275A	Transistor Test Set	100.

MARCONI

TF1313	Universal Bridge	500.
TF928/2	Deviation Meter (new)	200.
TF801D/1	A.M. Signal Generator	600.

MILITARY GEAR

TS-218/UP	Echo Box	$100
TS-155C/UP	Signal Generator	75.
ME-51/UP	Freq. and Power Meas.	write
TS-419/U	Signal Generator	300.
TS-191U/P		write
RT-194A/UPX-1	Radar Receiver	write
TS-537/TSA	Crystal Checker	150.

TEKTRONIX

(All scopes with plug-ins)

531	Rack Mounted	$200.
535	Rack Mounted, with dual trace	350.
543A	In Cabinet, with B Head	500.
545A	In Cabinet, with CA	575.

GENERAL RADIO

Unit Oscillators - 1208A, 1209B, 1211A 1218A, each	$100.
Unit Power Supplies - 1203A, 1204B ,each	35.
Unit I.F. Amplifiers 1217A	75.
Unit Pulser - 1216A	75.
Signal Generator 1021 P.3 with 1021P1 Power Supply	400.
Signal Generator 1021 P.4 with 1021P1 Power Supply	400
R.F. Bridge - 916AL, like new cond	250.
No.1482 Inductors (most letters in stock, like new) each	75.
Phase ∠ Voltmeter, North Atlantic	35.
Bird No. 8329, 2 kw coax term., 40 db attenuation	200.00

LED 115 v.a.c. Clock Kit, 6 digits No. 64 readouts). Complete with board, instruction book, and power transformer. $25.00

Burroughs Acme (limited Qty) 250 watt filament trans., pri. 110 or 220v., 12v.c.t. @ 3A, 34-0-34v @ 8A, 14 lbs. $10.00

CIMRON DIGITAL VOLT-RATIOMETER. No. P9300B, with multi meter converter 6980B, exc. cond. $750.00

JULIE RESEARCH DR-503 resistance Decade Box (Calibration Cert.) $250.00

TRANSFORMERS

Stancor 2.5 v. @ 1.5 A	$2.00
RCA - 6 v. @ 1A & 20v. @ .5A	2.00
RCA - 12v @ 1A	2.00
RCA - 20v @ 1A, 6v @ .5A	2.00
Philco - 24V @ 1A, 6v @ 1A	2.00
36v. @ 3A, 30v @ 1A, 6v. @ 1A	5.00
RCA - 2500 to 8 ohm v.c. OT	.50
RCA - 4500 to 8 ohm v.c. OT	1.00
Stancor minitran 1/2" X 1/2", Pri. 50 ohm - 50 ohm to 500 ohm sec	1.00

RELAYS

6 v reed n.o.	$1.00
12 v reed n.o.	1.00
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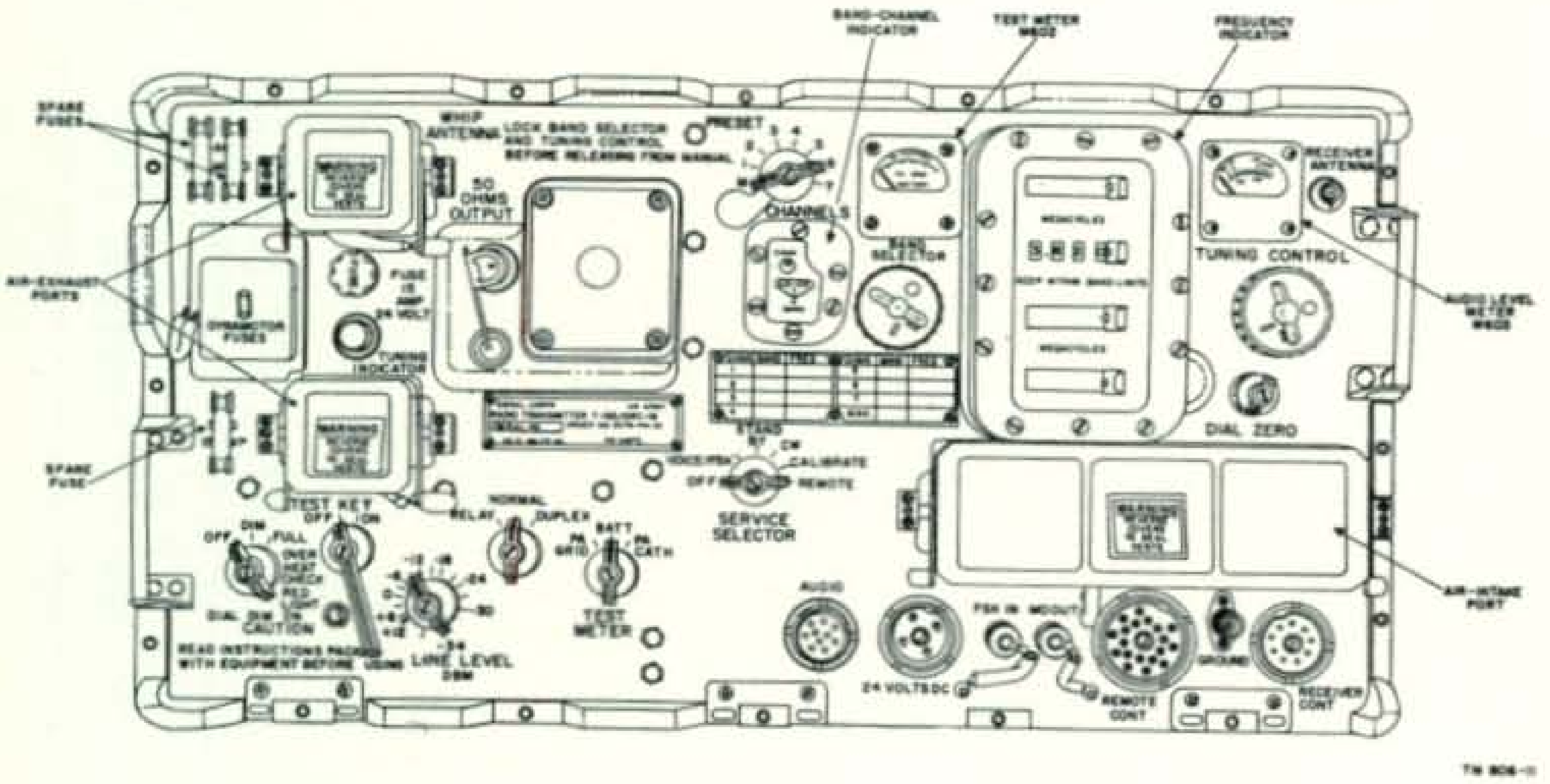
SURPLUS sidelights

BY GORDON ELIOT WHITE*

As I promised last month, here is a bit more on the T-195 transmitter, companion piece to the 24 volt R-392 receiver.

The manual I have is *TM-11-806*, which covers only the T-195. *TM 11-274* deals with the whole AN/GRC-19 (Angry-19 we used to call it in the Artillery).

Frequency stability of the set is rated .03 percent plus 1000 Hz from 1.5-20 MHz. Reliable Army range, with the 15 foot whip antenna was estimated as 50 miles. Radiated power ranges up to 100 watts, depending on type of antenna and frequency used.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RELAY NORMAL DUPLEX
BATT PA GRID PA CATH
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TEST METER
AUDIO
24 VOLTS DC
FSK IN
MOD OUT
REMOTE CONT
GROUND
RECEIVER CONT
TM 806-11

Fig. 1—Front panel drawing of the T-195/GRC-19 transmitter.

This unit is of typical Army olive-drab in a rugged carrying case—the sort of set that you could drop from a cargo plane on a ribbon 'chute and be pretty certain it would work when you picked is up.

Cooling is by an internal blower. Tuning of the oscillator is done in a Collins permeability-tuned unit similar to that of the R-390, the 51-J-4, and other well-known Collins designs. The output is matched to the antenna over the various bands via a pair of roller inductors, and the whole works is controlled by a autotune unit, having eight channels.

There are eight removable sub-chassis in the case. B+ power is derived from two old reliable, inefficient, dynamotors. One of the best reasons for solid-state equipment is the elimination of the dynamotor, a heavy, noisy clunker of an invention which is about 20 percent efficient. Fortunately for the Artillery, the Angry-19 was a ground set and we could carry portable generators to take over when the 24 volt batteries in the jeeps couldn't carry the load.

Figure 1 is the front panel of the transmitter. Figure 2 is the block diagram.

My impression is that this is a pretty hefty unit to lug around just to get out 100 watts, particularly if you don't have a handy 24 volt source around. If you have a surplus generator it looks a bit better. Otherwise you might want to deep six the dynamotors and install a d.c.-d.c. converter, for battery use in the field, or a simpler a.c.-powered power supply. There is about enough room in the dyna-

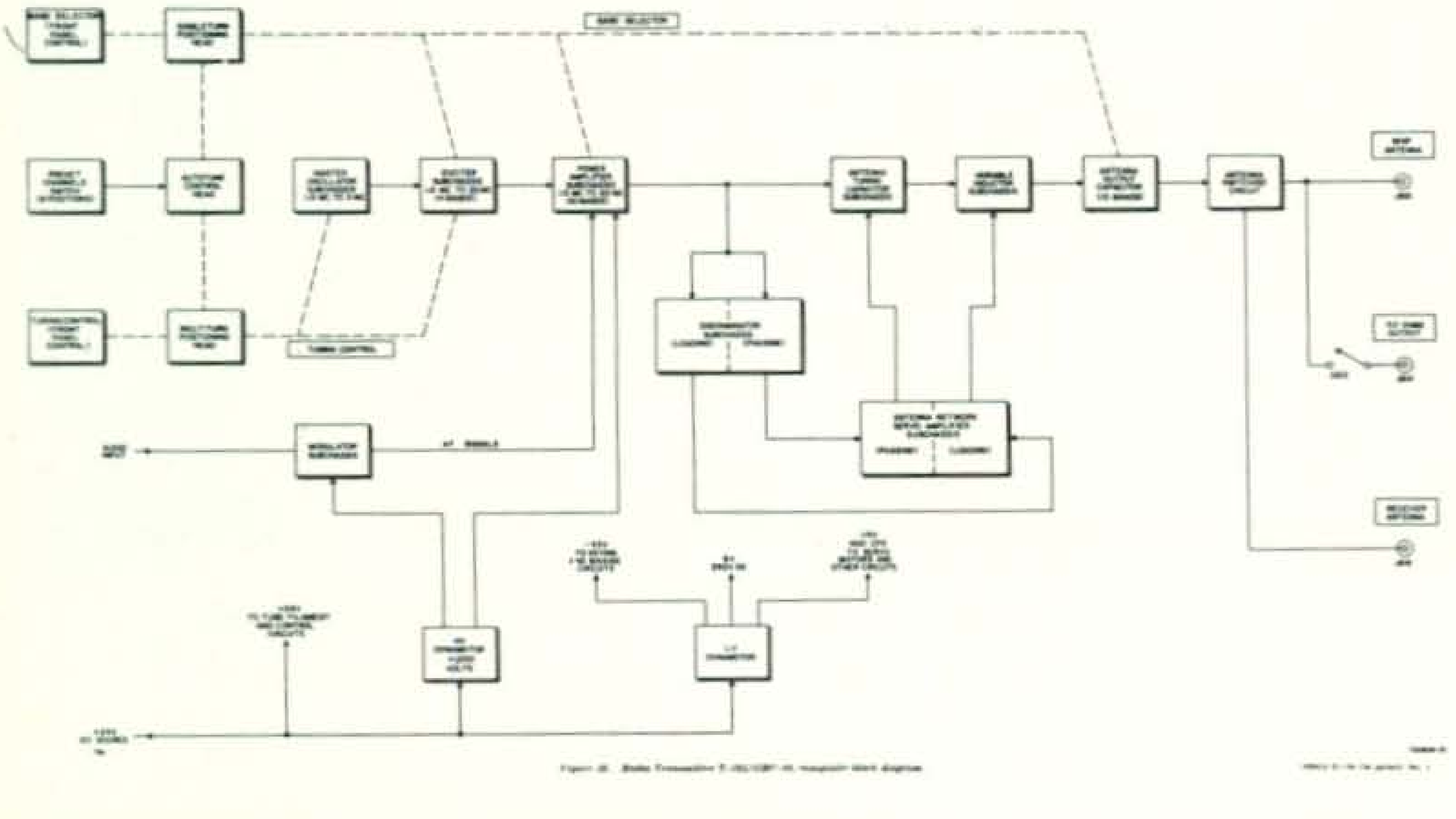

Fig. 2—Block diagram of the T-195/GRC-9 transmitter.

---

*1502 Stonewall Rd., Alexandria, VA. 22302.

motor well to pack in a transformer supply.

An operating caution: You must open the air vents on the front panel before firing up or you will melt the tubes in the final, pronto.

The master oscillator operates in the 1.5-3 MHz range, with appropriate multiplier stages to get to the 20 MHz upper limit of coverage. It would obviously be possible to up the ante a bit in the multipliers and go to 15, 10, or even six meters, but the bother of redoing everything through the autotune output stages is probably not worth it. Whether you can cheat enough at the upper end of the 20 MHz range to edge into 15 meters is a question I have not worked out. It might be possible.

Since the T-195 is a complex set, built with racks of permeability-tuned intermediate frequency coils controlled by an intricate system of cams and gears, much like the R-390A receiver, I suspect that modifying it would be a losing proposition. Unless you are a mechanical genius, stick to adding a power supply and other minor mods.

Voltages involved in the set are 24 d.c. volts for the filaments, relays, thermostats and blowers, dial lamps, tuning motors, etc. Alternating current at 400 Hz, 115 volts is required for the two servo motors and the "chopper;" 250 volts d.c. is needed for tube plate and screen voltages.

A negative 45 volts d.c. is needed for some tube bias points, and the antenna switching and keying circuits. High-voltage at 1000 v.d.c. is provided for the output amplifier plate and screen, and to the center tap on the modulation transformer. ■

Awards [*from page 67*]

18 via Generale Di Giorgio, 90143 Palermo (Sicily), Italy. He has a printed folder called *IT1AGA/IT9AGA "STORY"*. He is a retired bank manager, born Dec. 6, 1897 and active (strictly c.w.) since March 1952. He lists his many impressive/important accomplishments, club memberships, 400 Awards (including USA-CA-500-#74 dated 4-10-61-All A-1), about 61,000 QSOs and about 26,000 QSLs received —Yes, his *"Story"* could fill my whole column. (I dislike bringing up a very sensitive point, but for years attempts have been made to have IT1/IT9 count as a separate country in DXCC like IS, but all attempts have been turned down. At one point, all I & IT & IS stations refused to QSO/QSL U.S. stations).

How was *Your* month? 73, Ed., W2GT.

Plumbers Delight [*from page 37*]

The power carrying capacity is proportional to the square of the breakdown voltage. The figure shows the power capacity peaks at a Z_o of 30 ohms.

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Note from the figure that no value of Z_o (that is, D/d) is optimum for these three transmission line characteristics. A compromise is necessary.

During World War II, a committee recommended to the U.S. Navy that an impedance of 50 ohms be selected as a compromise between the three transmission line characteristics and *commercially available copper water pipe sizes.* Copper water pipe was used in fabricating coaxial transmission lines in those days. Now you know why coax is called plumbing. Where would the communications field be today if the plumbers hadn't come to the rescue? ■

SSB and CW QSK [*from page 26*]

idea. Thanks also are due to several whose circuit ideas were drawn upon for this project, including W6RM, W4AX, K3YUA, WA2BLV, and others whom we are sure have been missed. Also thanks to W7TX for helpful discussions. Finally, thanks to the many hams who helped with their reports, criticism, and comments during the numerous test sessions on the air using the original relay version through to the final product. ■

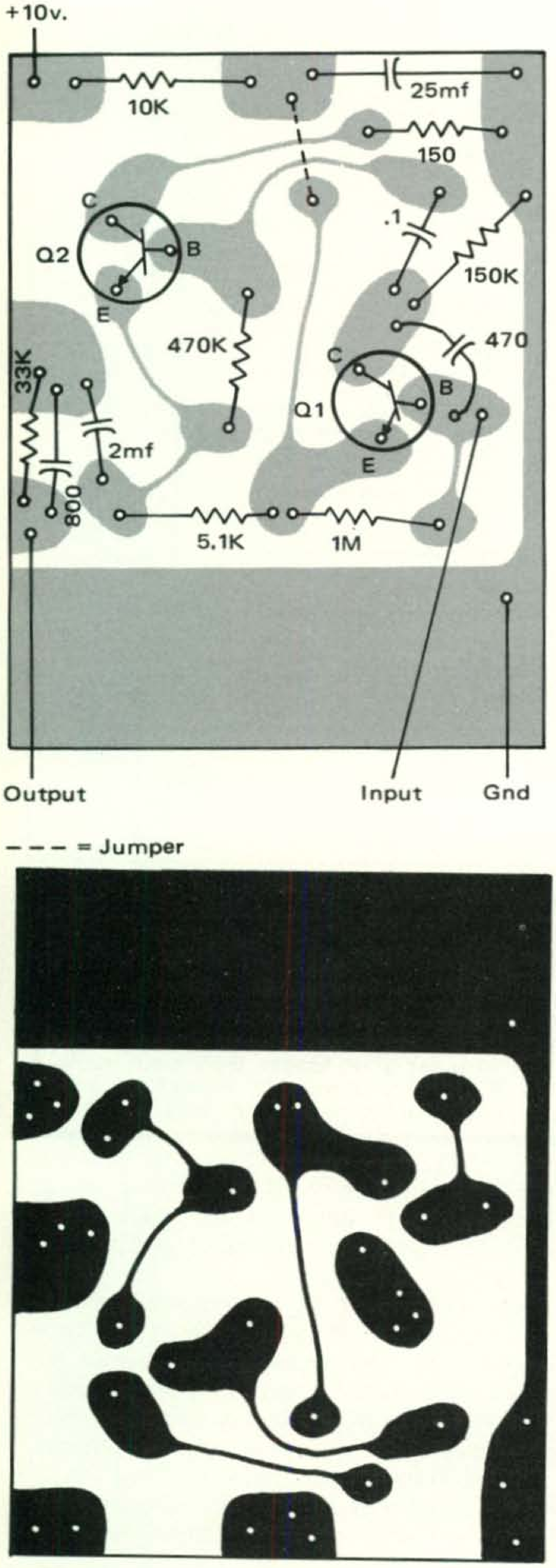
+10v.
10K
25mf
150
.1
150K
C
Q2
B
E
470K
470
C
Q1
B
E
33K
2mf
800
5.1K
1M
Output
Input
Gnd
– – – = Jumper

Fig. 10—Pre-amp board and parts placement.

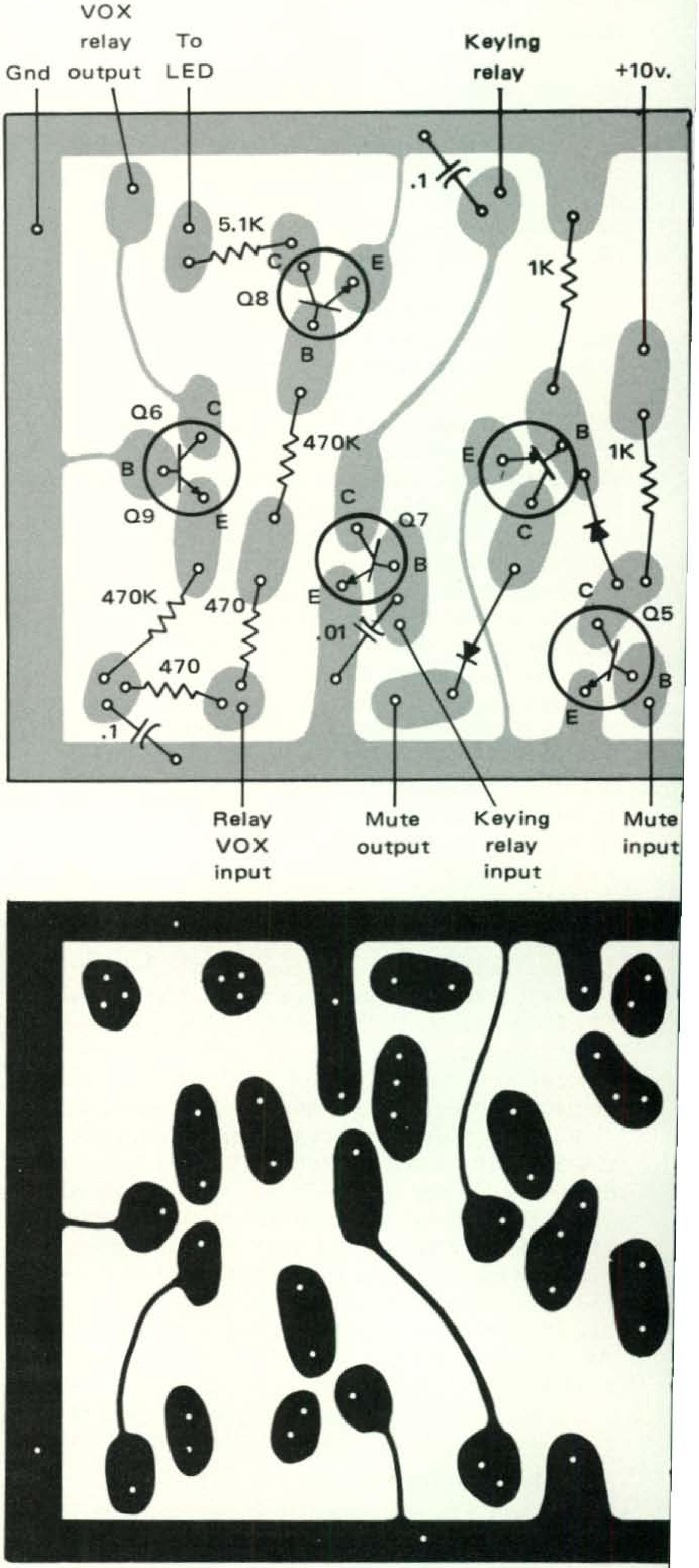
VOX relay output
To LED
Gnd
Keying relay
+10v.
.1
5.1K
C
E
Q8
B
1K
Q6
C
B
Q9
E
470K
C
Q7
B
E
E
B
C
1K
470K
470
.01
470
.1
C
Q5
B
E
Relay VOX input
Mute output
Keying relay input
Mute input

Fig. 11—Control board layout and parts placement.

Hum [*from page 34*]

mionic tubes, and is for a tube of the equipotential cathode type wherein the cathode may be energized by an alternating current." McCullough, in his next patent, does the same. This might have been the idea of C. M. Clark, their patent attorney. But I prefer to credit Koch.

Now comes 1926 and production. The first subcontractor who actually made the tubes in quantity was the AC Neon Corporation. Later, two other companies were involved.

And with the very first tubes on the line came trouble. As each tube was flashed, its cathode went west in a shower of sparks. McCullough used the conventional 201-A type processing and the 201-A type metallic getter tab which was tacked to the plate. A coil dropped over the tube and excited with r.f. would heat the elements and evaporate the getter, completely covering the inside of the glass with a mirror coating. In a battery tube, the filament was not affected, because of its tiny cross-section. But McCullough's tube cathode was nearly the size of a '99 plate. Eddy currents, added to space current and heating current was just too much. McCullough recognized the problem instantly, which is not surprising. It is a wonder that he didn't encounter this trouble in his prototypes. His solution is direct—he came up with a fox-goose-corn sub-routine and patented it. (Number 1,677,900).

Now, my own experience with these tubes: I had a tooth that was killing me, and I contracted to build a 5-tube a.c. receiver for a society dentist I was referred to. I was very young but nevertheless had some experience assembling Neutrodyne kits. His specifications were rigid: It must have a quality cabinet like another of mine he had seen, (my father had built it); it must be *absolutely* free from hum, and it must on no account use any kind of battery, even for bias purposes. I agreed to all this; I would have agreed to having a hole bored in my head. Dad built the cabinet, the dentist advanced the money to buy a Raytheon "B" Eliminator, parts, and five McCullough tubes. How could I go wrong? There *couldn't* be any hum, the cathodes were *indirectly* heated.

Ha! Up to that time, I had had no experience with a.c. receivers—nobody had—and I found that there were more ways for those tubes to hum than you can shake a stick at. And I wasn't even at my *then* best with my aching teeth. The resultant receiver was marginal, to be sure. The dentist, of course, considered this to be fraud on my part. When I got my first job, I continued with him, and paid Peachtree-Circle prices. He got his money back, and I got a Torquemada root-canal job.

Besides a fear of dentists, I had a sense of failure from this incident. I felt at fault and that affected my career also in those depression years. And even now I can't stand the hum that results when my TV contrast control is mis-adjusted.

In retrospect, I was obviously the victim of an impossible set of specifications. Listeners of that day were DX fiends—the idea was to see how far they could "catch" a station. The best receiver for this was the Neutrodyne—two neutralized triode r.f. stages, detector, and two audio. All batteries, of course, and off station they sounded dead, even in a headset. This was my competition and my standard! I was licked before I started.

Hum *can* be reduced to negligible proportions if you know the technique and can afford the time and trouble. Here is what you have to do: (A) Feed each heater from a separate transformer winding. You can reduce hum by as much as 10 db by deriving the centertap from an adjustable pot rather than from a center-tapped winding. The balance point may vary with individual tubes. (B) The center-tap slider on the pot must then be grounded, or biased negative with respect to the cathode, or positive whichever gives the least hum. You can wind up with one of each. (C) Since capacitance between a heater-wire and the grid can introduce hum, it may be necessary to balance this also in some fashion. (D) Shielding of the tube may be required. (E) Certainly, any a.c. field, such as that from a filter choke or power transformer must be kept well away from the tube. (F) And the British discovered that a tube will pick up a permanent magnetism which contributes to hum in some way. They recommend that tubes be demagnitized like a watch, and with the same equipment.

In theory, each tube should get the full treatment, but this never happens. Any non-linear stage is sensitive to hum, as well as vibration. This includes detectors and converters, of course.

In its commercial broadcast receivers, RCA and the companies that followed used a simple center-tapped winding for the filament-type tubes (UX-226) and another for the heater-type 227 detector and let it go at that. It was simply too expensive to fiddle around with laboratory adjustments on an assembly line. The sets all hummed, of course, you couldn't use a headset on them. Compared to the Neutrodyne, they were *impossible*.

Just as it is, nowadays, easier to disarm citizens than it is to reduce crime, then it was easier to mount a big propaganda campaign than to build a humless receiver. Not that I blame them—it is difficult enough to build such a receiver today, not to mention too costly.

People were still resisting the noisy sets, and the salesmen were getting agitated. Then it was pointed out to everyone that DX listening was puerile, fit only for the recluse and the eccentric. Network broadcasting was the McCoy (translation: where it's at) and why strain for DX and receive, poorly, what you could get perfectly from your local network station? And it was true; with a fat local signal, you could ignore what hum the program failed to override.

The propaganda accomplished what technical development could hardly have done—secured acceptance for those noisy sets. Everyone had table-model radios, most of them boxes with a speaker mounted above the chassis. The cabinet curved up to a ridge, like on a house. They were called "Miniature" and "cathedral-type." And I repeated this propaganda at every opportunity to show that I knew what was going on. All of us did.

The heart-breaking thing about propaganda is that it is spread, enthusiastically and at their own expense—by its chief victims. That hasn't changed.

RCA hasn't told me that they were using McCullough as a trial-horse, either, but that is how it figures. The early a.c. sets were hard to sell, (I was there, and I tried. Damned near starved), but the McCullough tubes and their successor, the UY-227 of RCA found ready acceptance.

McCullough sold his tubes for nearly a year until the big companies got under way. He did not make a fight of it; instead, he sold his design to Kellogg Switchboard and Supply, a telephone manufacturing company. Kellogg improved the tube, probably with some of McCullough's ideas as part of the deal. They made a very good receiver using their tubes, and both it and the tubes survived in a highly competitive market for years.

With such a limited production, the McCullough tube is quite rare. I haven't seen any in museums, nor heard of any. I believe none have survived. But the Kellogg is basically the same tube. It is the type pictured here of course. The differences:

(A) The McCullough had a Shaw base, with the short UV-type pins, and the bottom edge of the base was rounded, as if to make for easy insertion into a shell-type socket. (B) The glass was heavily flashed, 201-A fashion. (C) The heater insulation was of a tan color, and friable, as if it had been made of half-baked fire-clay. (D) They were marked McCullough without a type-number.

(E) Kellogg tubes were marked with the name, and a K on the heater connector, plus a number. Most usually, 401, but a 403 output tube is also known. (F) They used a standard UX-type base, with long pins, a locking pin on the side for shell sockets, and the base had a sharp bottom edge. (G) 401's used a side-mounted getter-pan in the modern fashion, which left the glass clear, as the illustration shows. (H) The heater insulation is not a ceramic, but has translucent, metallic sheen. I believe it is fused quartz.

Now, how about patents? How could RCA market a tube without infringing on McCullough's? As it happened, RCA had all the patent it needed. The basic patent on the indirectly-heated cathode was granted to a British subject, Alexander McLean Nicolson. He worked for the tube development department of Western Electric, which was then and still is an RCA affiliate. The patent number is 1,459,412; it is dated June 19, 1923. But it was applied for on April 16, 1915! Since the audion was invented in 1906, this is remarkably rapid development.

Nicolson's tube was not an a.c. tube at all. He was concerned with the bias introduced by the difference in potential across the filament of a tube. This reduces the output. And when tubes were operated in series, as they were and are in a telephone plant, the normal grid biasing is complicated. A.c.? Who had any a.c. back in those days? Who wanted it? The usual house-lighting was by natural gas. There was no big market for tubes, anyhow. Telephone companies, and a few radio stations—and every one of these used batteries.

The Nicolson tube used a single spiral strand of platinum, or a rod of carbon like a pencil lead for a heater. This was insulated by an enamel, and platinum was coated on this surface by chemical means. The platinum layer was then coated with the usual emittive surface.

Obviously, such a cathode would not even *work* on a.c. Talk about hum—with the heater going straight through, there was no EM field cancellation as there is with a hairpin loop, and you'd get more hum than signal. Nevertheless, it was an indirectly-heated cathode, the patent was basic, and it served the purpose.

Back in the post-McCullough era Arcturus, who later made the famous "Blue tubes" had a better idea. They found that the best cathode voltage was not 2.5 or 3 volts, but a full 15. This was because that voltage gave the best compromise as between current and voltage so far as hum was concerned. They produced an UX-based tube which used a carbon heater, with a current rating of 300 mils or less, at a guess. It was produced for the "electrifying" market—the changing of the large number of battery sets for a.c. operation. The base had only four prongs, so the cathode was connected to one of the "filament" prongs, probably number four, in modern notation. This was OK if that socket pin were grounded, which it usually was anyhow. Supply a toy transformer for the heaters and you were in business—you didn't even have to change the socket. This actually worked—Hugo Gernsback used it in some of his designs, but then it was impossible to use the new cathode biasing scheme. You were stuck with bias batteries, or a separate supply. And I think this killed a good tube. It wasn't around long.

Joe Cecil, W5AIQ, tells me that McCullough produced a single-ended, four-prong-based tube for the same market. This tube, unlike the Arcturus, was a low-voltage type like the 401 and '27, but the special feature was the cathode resistor and bypass capacitor mounted *in the base*. I never heard of it, but Joe knows his tubes, and he is certain that it was a McCullough.

I have belabored the point that the a.c. tube (even today) is in some measure the triumph of propaganda over technology. We accept a certain amount of hum, because in the circumstances we would be embarrassed not to. But even that problem is fading. With more crowding and less room available, antennas have grown smaller, at least, for receivers. We used to use resonant antennas; now a yard or two of wire draped over something is common. We get away with this because of the high gain of the modern receiver.

Our fathers said, "It has to hum a little. A motor hums, doesn't it?" Now we say: "Sure we get white noise. It goes with the gain. The more gain, the more noise." Perfectly true.

It is also said that on the low-frequency bands it does not pay to reduce receiver noise because antenna noise is much greater. True, maybe. The Neutrodyne operating in the broadcast band was wonderful, then. It might be totally inadequate, now. Only an actual trial would tell. The big question now is cross-mod because of the congestion of big signals. But think about this: every development in receiver design except the use of i.f. filters has served to increase receiver noise. More gain means more white noise, but does it have to mean so *much* more?

In this connection, I quote Bill Orr, re: the SW-3 description in July 1971 *CQ*: "To one accustomed to today's multi-stage, multi-tube (transistor) receiver, the quiet background noise and the high ear-phone level developed by the three-tube SW-3 is quite impressive."

And George Gabus in May 1963 *73* says that noise is greatly reduced by operating tubes at anode voltages below 18, to eliminate the effect of ionization. Not avalanche or blue-glow, but random and invisible. He also reduces heater temperatures about 25% to reduce stray ions. The result is a receiver that has greatly reduced output power, but practically no noise at all. Signals pop out of a dead background.

Bill Orr also wrote up the HRO receiver in May, 1975 *CQ*. National used to run a series of ads in which they explained some of the finer points of design, and answered questions of general interest about their receivers. One owner wanted to know why no noise limiter in the HRO? National said there wouldn't be room for one inside, and mounted externally it would look like a wart on a dill pickle. Besides, the HRO was so balanced (!) in design that a limiter wasn't really necessary. I pondered this answer for years, and finally concluded that the beating oscillator output was introduced into the mixer and detector at such a low level that it limited the signal.

The Moon-bouncers use another approach. They actually *filter* the oscillator to remove its noise component. With a fixed frequency, naturally.

Even as a gift, a low-noise receiver will be costly. Stripping away the squelching white-noise will expose you again to hum. And to static. Have you heard any static lately? And neon signs, motors, arcing power insulators and a host of other noisy beasts that the blanket of white noise has been covering up. The layers of low-level signals may, or may not make the effort worth-while, depending on your interests. You are not *obliged* to enjoy your hobby in any particular way.

But to buy such a receiver over the counter —well, some makes are better than others, but none have emphasized low noise so far as I know. Selectivity, stability, and all the other itties, yes. Now, do you remember how it was when s.s.b. first became popular? The receivers we had been using for years suddenly showed us how unstable they really were. Stubborn customers are probably the number one cause of improvements, so we now have receivers which will hold a signal all day. If customers started holding off buying until low-noise types were available——.

Solid State is supposed to cure everything, and it really has done a lot. But it's got white noise too. Want to know why I hate it so? After I listen a while, I think I hear voices in it, voices that are not quite intelligible. I don't, of course. At least, not with the antenna off. I believe I am hearing random low-frequency components that add up to nonsense syllables. It would be impossible, and too expensive, to get rid of white noise—but I do believe that even for the same gain, we could have a lot less of it with proper design. It is the next quantum-jump in receiver performance.

See what McCullough started?

A number of people helped me with this article, and I am grateful to them. Bill Orr, W6SAI, suggested I tackle the subject. Mr. Valentine of IT&T offered some welcome directions. To Jack McCullough, of Eimac, no relation, who gave me some good leads. Joe Cecil, W5AIQ for a tube to illustrate and information to go with it. Also to George

Swetnam, an historian of Glenshaw, Penn, who extracted what little information there was on Koch and McCullough. And last, but not least, to Gerald Tyne for insight and authoritative information. ■

Math's Notes *[from page 46]*

We will look into the subject of a power amplifier for this unit as many readers had requested, in the near future and will pass along details when we or one of our readers, comes up with a suitable design. In the meanwhile, if you have successfully converted RT-70's we would be glad to pass along your suggestions.

Incidently, Fair Radio Sales, 1016 East Eureka Street, Lima, Ohio, 45802 still has RT-70's and matching accessories in stock as do many other surplus outlets.

See you next month, 73, WA2NDM

Announcements *[from page 8]*

den Dr. For more information contact K4GOU, 2415 Concord Dr., Louisville KY 40217.

- **Ottawa, Ontario** - The Radio Society of Ontario's 1975 Convention will be held on October 3, 4 & 5. We offer a complete program of technical sessions, forums, commercial displays, etc. We also plan an Octoberfest for the socially minded. For further information contact RSO Convention, P.O. Box 8873, Ottawa, Ontario, Canada.
- **Passaic, New Jersey** - The Knight Raiders VHF Club's auction and flea market will be held on Sat. October 4th, at St. Joseph's Church of East Rutherford. Refreshments are available. $5.00 is for a full flea market table, and $3.00 for a half. For reserving tables and information write to The Knight Raiders VHF Club, Inc., K2DEL, P.O. Box 1054 Passaic, NJ 07055.
- **La Marque, Texas** - The Tidelands Amateur Radio Society's Annual Hamfest is Sunday October 5 at 9 a.m. It will be held at the Galveston County Park, League City. Advance registration is $1.50 and $2 at the door. For info, sned S.A.S.E. to: Luke Sterling, WB5FIE, 105 Seabreeze Drive, League City, TX 77573.
- **Philadelphia, Pennsylvania** - The Mt. Airy VHF Radio Club annual Pack Rat Hamarama is Sunday October 5th at the Buck County Drive-In Theater located on Route 611 in Warrington, PA. There will be many activities for everyone and food concessions will be on the premises. Registration is $1.00 and tail gate selling only $2.00. For further information and flier - SASE to K3MXM - Lee A. Cohen - 8242 Brookside Road - Elkins Park, PA 19117.
- **Syracuse, New York** - The eleventh annual Radio Amateurs of Greater Syracuse Hamfest will be Sat. October 11 from 9 a.m. to 6 p.m. It will be held at the Syracuse Auto Auction, 4 miles south of Syracuse on U.S. Route 11 between Nedrow and LaFayette, NY. Donations at the door is $2.00 before October 1st is $1.50. For more information contact WA3UBT, Allan Brown, 128 Atkinson Ave. Syracuse, NY 13207.
- **Bedford, IN** - The Annual Spring Mill Hamfest sponsored by the Hossier Hills Ham Club, P.O. Box 375, Bedford IN 47421, will be held Sunday Oct. 12 at Spring Mill State Park. There will many prizes and entertainment for the entire family. For info contact W9YJD at the above address.
- **The Address for Far East Aux Radio League** - Fearl QSL Bureau, c/o Sam Fleming, Garh-ID-GS-T APO San Francisco, CA 96343.

DX *[from page 61]*

XL3—XL3HFS, operated by VE3HFS, was a special prefix commemmorating the start of construction on the Canadian Pacific Railroad. Others active included XL3EDC (VE3-EDC) and XL3SEC (VE3SEC). QSL XL3-SEC and VE3UW.

YZ1 & YZ2—These were special Yugoslav prefixes. YZ1NOT was YU1NOT, YZ1EXY was YU1EXY, YZ2CCM was YU2CCM, etc.

QSL Information

A6XB—Via K1DRN
A6XN—To DJ9ZD
A6XR—c/o G4CNP
A35FF—Via Bruce Giunta, W6KLI, 16933 Loukelton, Valinda, CA 91744
CE0AE—To WA3HUP
CN8BX—c/o F8CH
CR8AG—Via CT1SH
F0WV/FC—To ON4TJ
FC2CD—c/o W4KA
FC2CH—Via WA8TDY
FG7AN—To WA3EDS
FM0BKZ—c/o F6BBJ
FM0BQQ—Via W6HJP
FO8DH—To F6BXL
FP0JD—c/o W2DEO
G3JXE—Via Tom Dornback, K9MKX, 2515 College Rd., Downers Grove, IL 60515
G3VGU—To Larry Cotarius, WA9MZS, 8041 N. Hamlin Skokie, IL 60076
GC4DAA—c/o G3FXB
GM5AXO—To WA4UAZ
HC5EE—Via WA8TDY
HC5EJ—To WA8TDY
HC5LJ—c/o WA8TDY
HD1QRC—Via WA8TDY
HD0QRC—To WA8TDY
HK0AA—c/o L.C.R.A., P.O. Box 584, Bogota, Columbia
HS2AIG—Via WA4BKC
IF9JLG—To P.O. Box 85, Trapani, Sicily, Italy
IM0CBM—c/o I2YDX
JW9TM—Via LA9TM
KH6GKD/KB6—To KH6GKD
KS6FF—c/o W6LI
KX6ZZ—Via VE3GUS, 72 Woodward Ave., Thornhill, Ontario, Canada L3T 1E7
KZ5NG and **KZ5BP—c/o** WA4UAZ
OE5CA/YK—To OE5REB
OJ0AM—c/o OH0AM
OX5BW—Via P.O. Box 543, APO, New York, N.Y. 09023
P29UC—To WA7ILC
PJ9CDC—c/o Alex M. Kasevich, W1CDC, 43 Dover Rd., Manchester, CT 06040
PU0YS—Via PY7YS
PV0AKL—To PY4AKL
PY7AXQ—c/o K9MKX
PY0YS—Via PY7YS, P.O. Box 34, 60000—Forteleza—Ceara, Brazil
TA1HY—To W5QPX
TI2AJF—c/o W9 QSL Bureau
VE3EZM/C21—Via VE3GUS
VE3EZM—To VE3GUS
VE8RCS—c/o WA7OBH, 728 Division, Hardin, Montana 59034
VK2BZM and **VK2BZM/9**—Via VE3GUS
VP1MT—To G4RS
VP2D/W2DEO—c/o W2DEO
VP2LBJ—Via W2DEO
VB2LBR—To K2GIW
VQ9WL—c/o WA2RUD
VR1PE—Via Mike Berkwit, KH6GKD, 92-574 Akaula St., Ewa Beach, HI 96706
VR4AZ—To VE3GUS
W2DEO/HR2—c/o W2DEO, James M. Du Pont, 391 Valley Rd., Watchung, N.J. 07060
W2DEO/VP2S—Via W2DEO
W2DEO/8R1—To W2DEO
WB8ABN/HC0—c/o WA8TDY
YN1DEO/5—Via W2DEO
YU1AJF—To W1CDC
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6Y5LA—Via W2DEO
8P6GL—To W2DEO
9K2DX—c/o W6LU
9M2FK—Via YU4HA
9M8HG—To GW3OJB
9M8VLC—c/o WA7PEZ
9X5PT—Via VE3BOZ
9Y4TR—To WA5GFS

73, John, K4IIF

In Focus [*from page 53*]

While you're at it, ask for their *Intel Data Catalog for 1975.*

Next month look for more comments on scan conversion and more on the resolution chart for SSTV. Don't forget that other SSTV-minded amateurs all over the world are interested in what you are doing. Please address your letters to 2112 Turk Hill Road, Fairport, N.Y. 14450, and send along a photo or two of your pet project. 73, Bill, W2DD

Novice [*from page 57*]

AYA, P.O. Box 205, Willingboro, N.J. 08046, asks if anyone has been able to identify the source of the RTTY signal on approximately 3704 kHz that often chops up the low end of the 80 meter Novice band. Our guess is that there are several of them, possibly in Spain, Cuba, and Venezuela. Tom, by the way, writes the DX KORNER in *S9 Magazine* and contributes regularly to other electronic journals.

Now that Technicians will again have Novice privileges, as they did until a few years ago, these shortened comments by **Frank, WB5JBL,** in the *CORA Collector And Emitter*, Oklahoma City, Okla., are particularly timely: "It took me 40 years to get my Technician license. I don't mind telling you that it was a comedown to realize that the word was going around that Technicians had cheated to get their licenses. So once more, I studied theory and practiced code and passed my Advanced examination, not so much that I wanted the extra privileges, but to rid myself of the stigma that went along with my license. Now I challenge anyone who has personal knowledge of any fraud in obtaining an Amateur license and can prove it, come forward and say so in public. If he cannot prove his allegations, knock them off." We say, "Amen!" And congratulations to Frank.

Before I close out this month's NOVICE SHACK, when you read these words, I will be in the midst of the problem facing all new Novices: what to do about a transmitting antenna because I am abandoning the challenges of operating an Amateur station in a city in favor of what the expensive real estate advertisements call "the advantages of quiet suburban living." Any suggestions welcome.

Back to work. Remember, what appears in your NOVICE SHACK depends in large part on your suggestions and contributions and pictures. You do not have to be a Novice to contribute; just be young at heart. A problem that you might consider is should we change the name of the column when the new regulations go into effect. If so, to what? Send your letters, pictures, etc., to the new address at the front of the column. 73, Herb, W9EGQ

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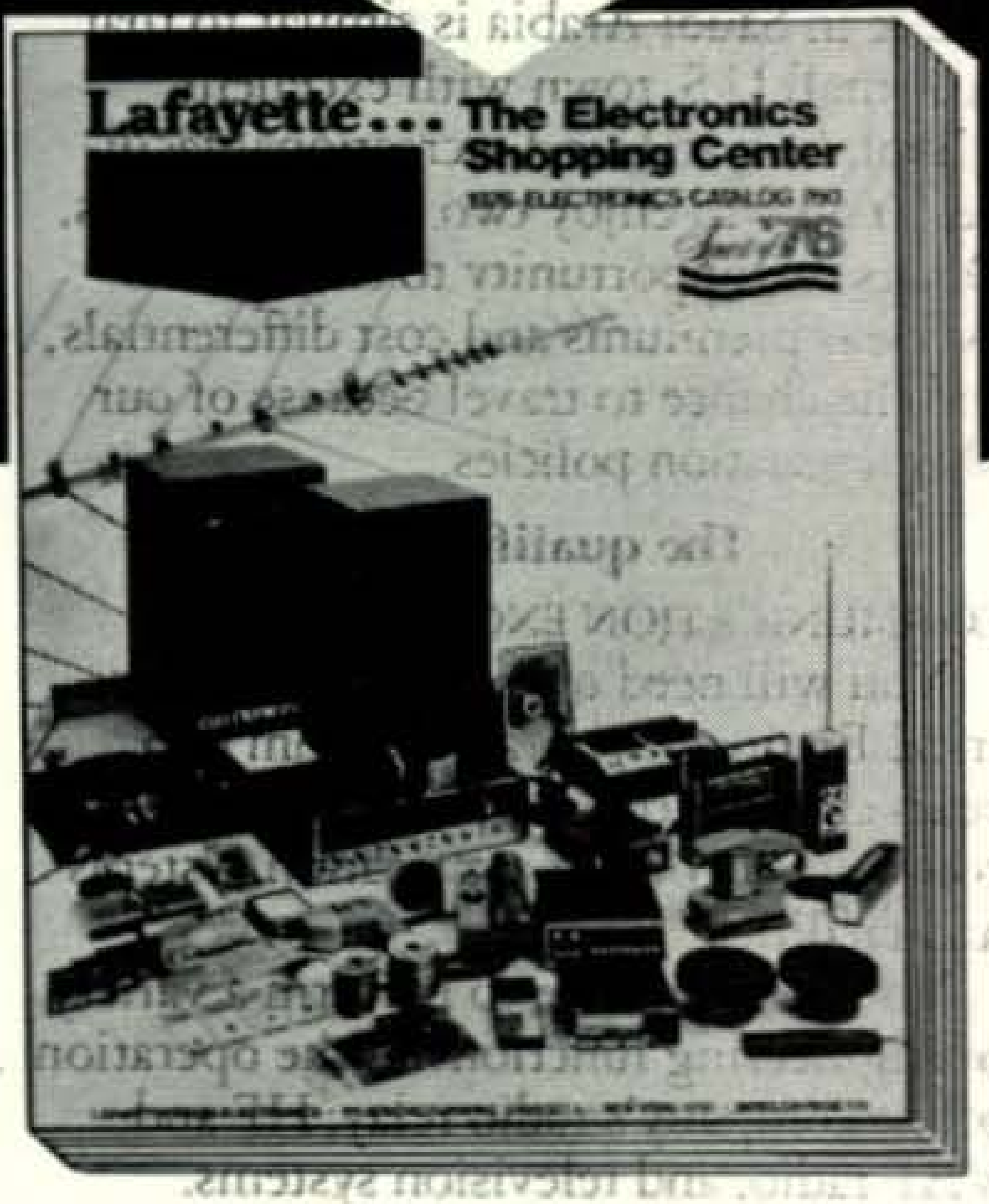

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Propagation [*from page 65*]

McMurdo Sound, Antarctica	15-17 (1)	17-20 (1) 20-22 (2) 22-00 (1) 08-10 (1)	00-03 (1) 03-05 (2) 05-07 (1)	04-06 (1)

Time Zones: PDT (24-Hour Time)
WESTERN USA TO:

	15 Meters	*20 Meters*	*40 Meters*	*80 Meters*
Western & Southern Europe & North Africa	10-12 (1)	07-08 (1) 08-10 (2) 10-12 (1) 12-14 (2) 14-16 (1) 22-00 (1)	20-21 (1) 21-23 (2) 23-00 (1)	21-23 (1)
Central & Northern Europe & European USSR	10-12 (1)	08-09 (1) 09-10 (2) 10-12 (1) 12-14 (2) 14-15 (1) 22-00 (1)	20-00 (1)	21-23 (1)
Eastern Mediterranean & Middle East	*Nil*	08-12 (1) 12-14 (2) 14-16 (1) 20-22 (1)	20-23 (1)	21-22 (1)
Western Africa	11-14 (1)	07-08 (1) 08-09 (2) 09-14 (1) 14-17 (2) 17-18 (1)	21-00 (1)	22-23 (1)
Eastern & Central Africa	11-14 (1)	07-09 (1) 13-15 (1) 15-17 (2) 17-18 (1) 21-23 (1)	20-22 (1)	*Nil*
Southern Africa	10-14 (1)	07-09 (1) 12-14 (1) 14-16 (2) 16-18 (1) 22-00 (1)	10-20 (1) 20-22 (2) 22-23 (1)	20-22 (1)
Central & South Asia	17-19 (1)	08-09 (1) 09-11 (2) 11-13 (1) 17-19 (1) 19-21 (2) 21-22 (1)	06-08 (1) 19-21 (1)	*Nil*
Southeast Asia	16-19 (1)	07-08 (1) 08-10 (3) 10-11 (2) 11-12 (1) 21-22 (1) 22-00 (2) 00-01 (1)	01-03 (1) 03-06 (2) 06-08 (1)	03-06 (1)
Far East	16-19 (1)	07-08 (1) 08-10 (3) 10-13 (2) 13-18 (1) 18-19 (2) 19-21 (3) 21-22 (2) 22-23 (1)	01-02 (1) 02-06 (2) 06-07 (3) 07-08 (2) 08-09 (1)	02-05 (1) 05-07 (2)* 07-08 (1)
South Pacific & New Zealand	12-15 (1) 15-16 (2)** 16-18 (3)** 18-19 (2) 19-20 (1)	07-08 (1) 08-10 (3) 10-11 (2) 11-14 (1) 14-18 (2) 18-20 (3) 20-22 (4) 22-23 (3) 23-00 (2) 00-02 (1)	21-22 (1) 22-23 (2) 23-00 (3) 00-05 (4) 05-07 (3) 07-08 (2) 08-09 (1)	23-02 (1) 02-07 (2)* 07-08 (1)
Australasia	13-16 (1) 16-19 (2)** 19-21 (1)	01-07 (1) 07-08 (1) 08-10 (3) 10-12 (2) 12-13 (1) 17-19 (1) 19-20 (2) 20-23 (3) 23-01 (2)	00-02 (1) 02-03 (2) 03-06 (3) 06-08 (2) 08-09 (1)	02-04 (1) 04-07 (2)* 07-08 (1)
Caribbean, Central America & Northern Countries of South America	08-09 (1) 09-11 (2) 11-13 (3)** 13-15 (4)** 15-16 (3)** 16-17 (2) 17-18 (1)	07-08 (1) 08-09 (2) 09-10 (3) 10-15 (2) 15-16 (3) 16-18 (4) 18-20 (3) 20-22 (2) 22-23 (1)	18-21 (1) 21-22 (3) 22-02 (4) 02-04 (3) 04-06 (2) 06-08 (1)	20-22 (1) 22-02 (2)* 02-04 (3)* 04-05 (2)* 05-06 (1)
Peru, Bolivia, Paraguay, Brazil, Chile, Argentina, & Uruguay	09-10 (1) 10-11 (2) 11-13 (1) 13-17 (2)** 17-18 (1)	08-10 (1) 13-15 (1) 15-17 (2) 17-20 (3) 20-21 (2) 21-23 (1)	20-21 (1) 21-01 (2) 01-03 (1) 03-04 (2) 04-06 (1)	22-00 (1) 00-04 (2)* 04-05 (1)
McMurdo Sound, Antarctica	16-18 (1)	08-10 (1) 17-19 (1) 19-20 (2) 20-22 (3) 22-23 (2) 23-00 (1)	01-03 (1) 03-05 (2) 05-07 (1)	03-06 (1)

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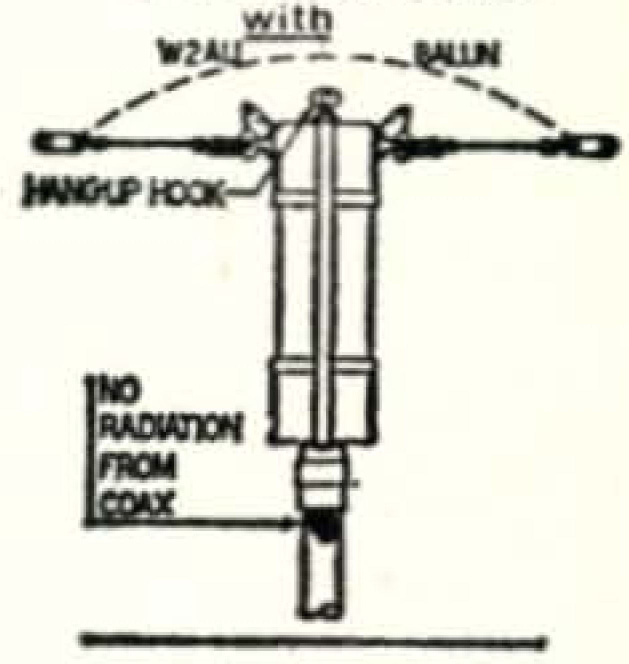
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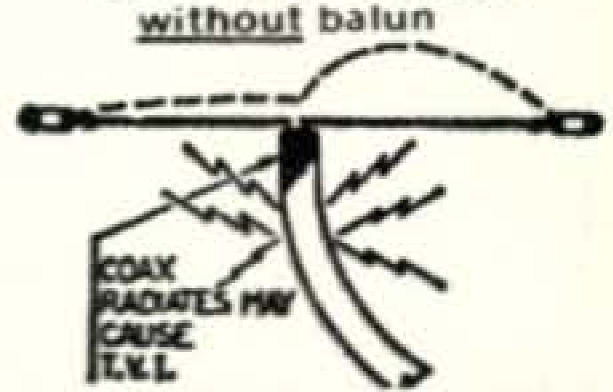
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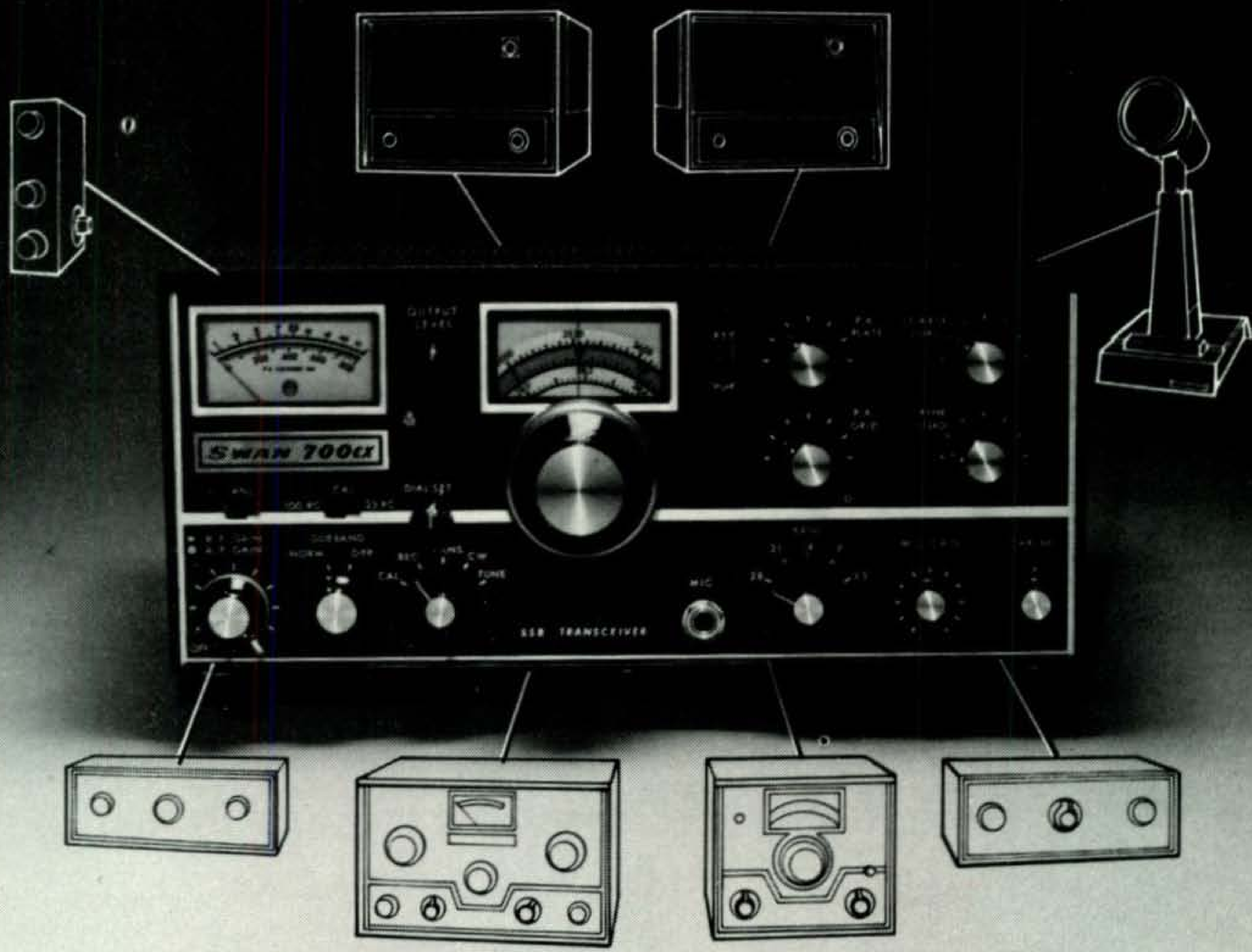

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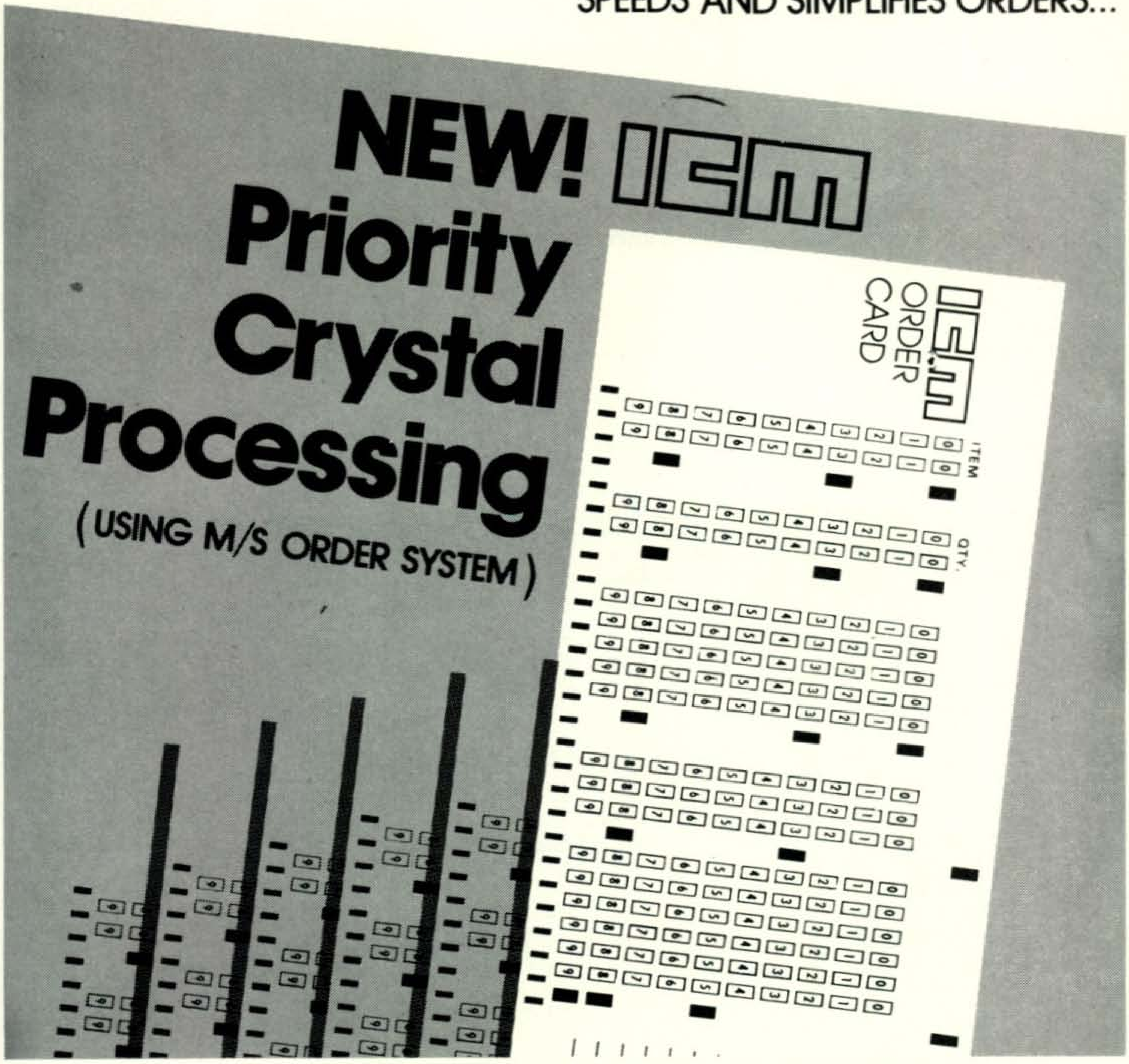

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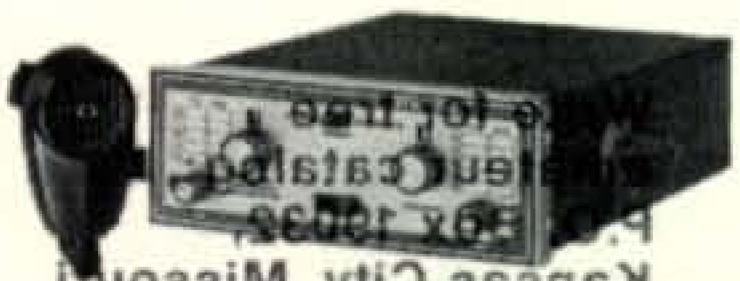

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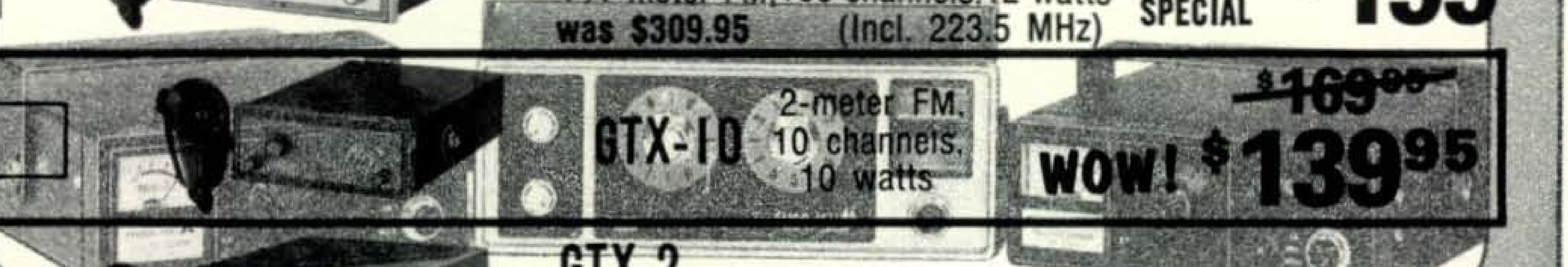

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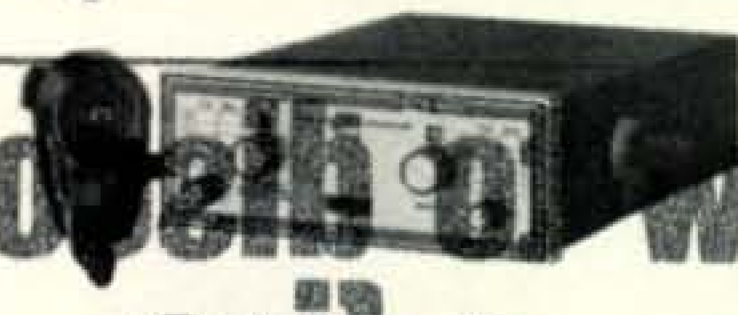

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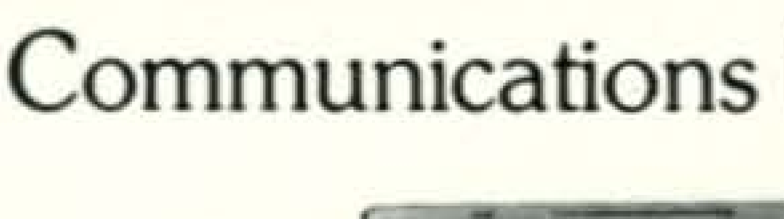

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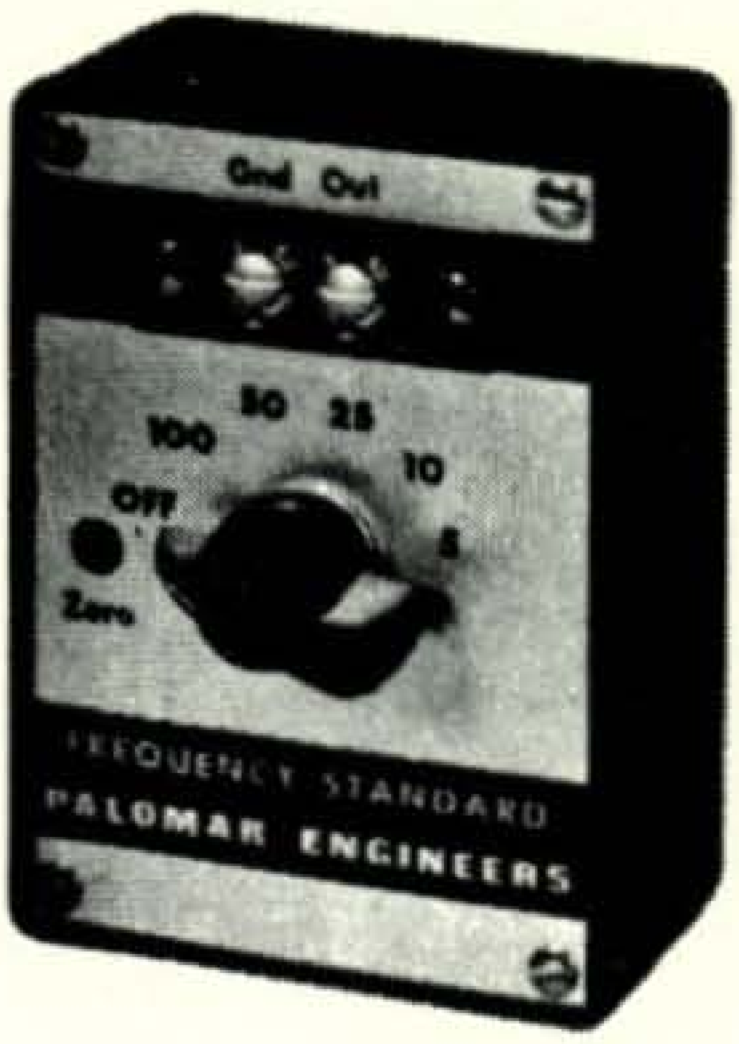

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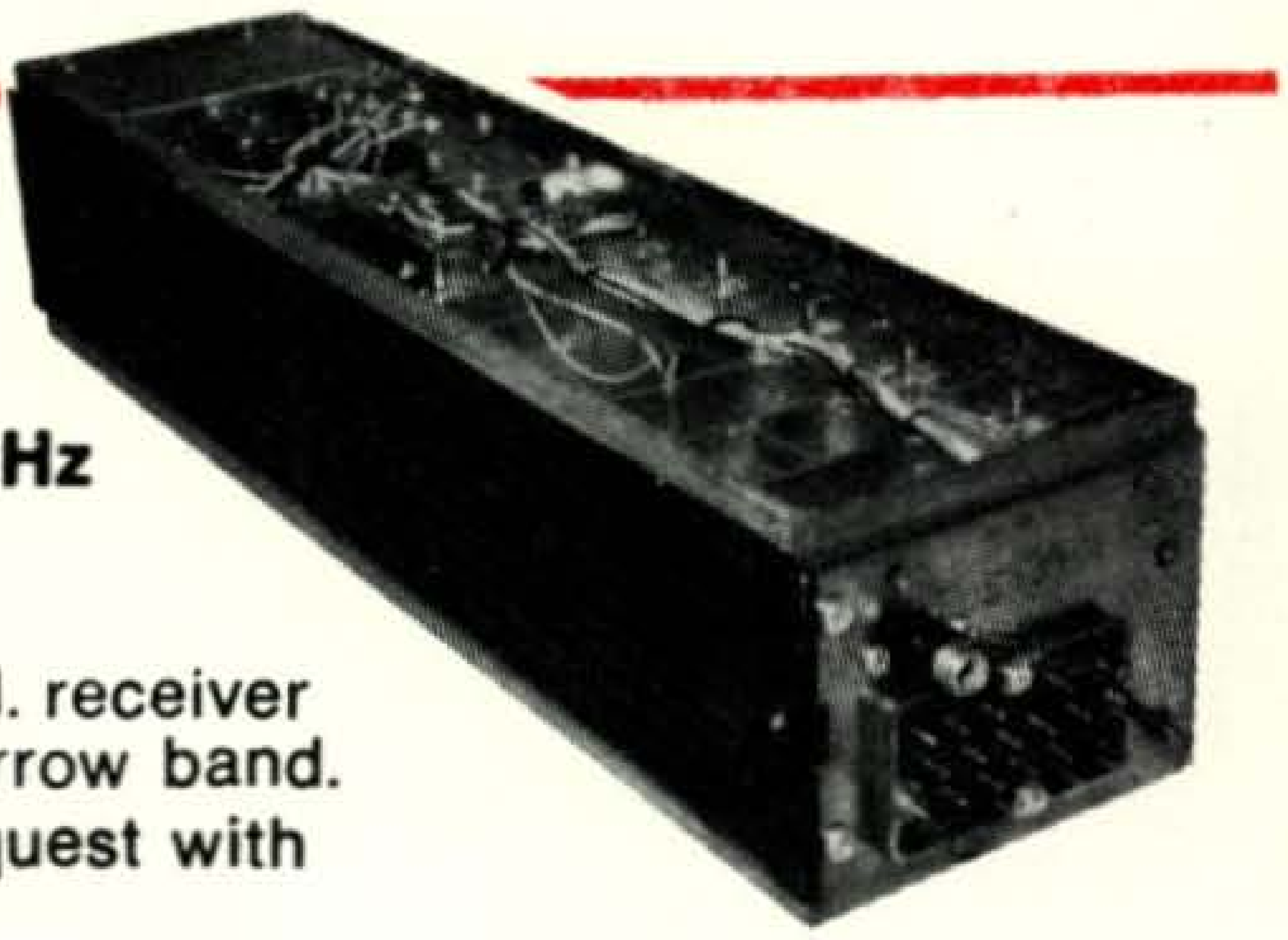

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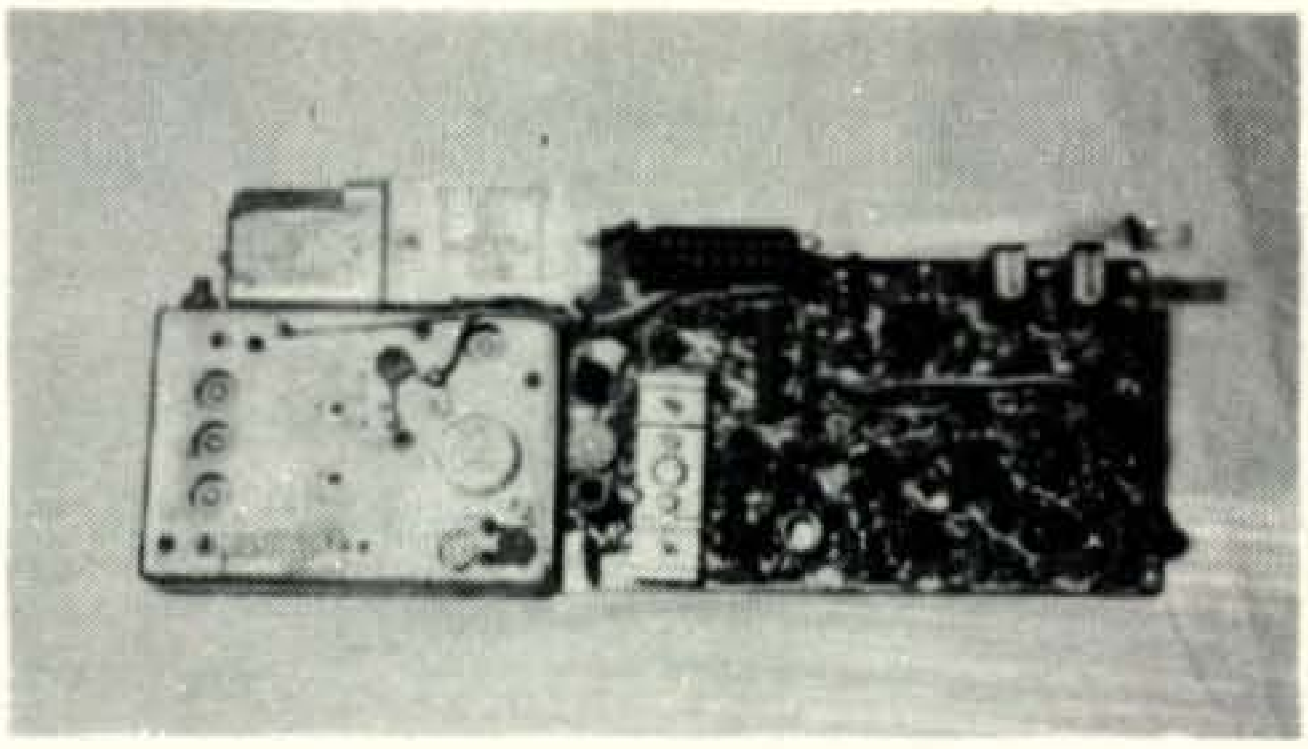

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